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THE EFFECT OF BILINGUAL PROFICIENCY ON THE ACHIEVEMENT IN COGNITIVE TASKS

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ABSTRACT

In this research, the effect of bilingual proficiency on the achievement in cognitive tasks was investigated. This was essentially a bilingual study on the Hong Kong secondary school students' understanding and cognitive functioning, revealed by the achievement scores and finishing time for the cognitive tasks chosen. The significance of the research lies in its relevance to the problem about the medium of instruction. In relation to the threshold level(s) in the second language, the possibility of identifying the students who are capable of receiving education through the second language was examined.

The two types of cognitive tasks chosen were: (1) summarization and (2) analogical reasoning. They were supposed to assess the mastery in inferential comprehension and abstract reasoning, respectively. In addition, the significance of lexical knowledge was tested with the two levels of basic vocabulary range: (1) 1,500 and (2) 3,000.

Two cohorts of Hong Kong secondary school students were sampled. For the main part of data analysis, the subjects consisted of 218 Secondary Two (8th grade) and 221 Secondary Four (10th grade) students. It had been assumed that most of them were bilinguals, with Chinese being their mother tongue and English their second

language. They took both the language tests for their respective academic levels and the cognitive tasks. And these subjects of each academic level could be differentiated into four groups of different combinations of bilingual proficiency for comparison.

It was found that there was significant effect of bilingual proficiency on the achievement in cognitive tasks. The only exception existed in the finishing time for the cognitive tasks in English for the Secondary Two students. The research findings suggested that the English cognitive tasks scores were directly affected by English proficiency in reading, taking into consideration their Chinese proficiency in reading. Also, the importance of lexical knowledge in English reading proficiency was shown.

The prediction that if individuals have attained a certain threshold level in the second language, they will be able to accomplish certain cognitive tasks in that language was confirmed. Estimations of the threshold level(s) in the second language can probably be made by using the regressions for the relationship between L2 reading proficiency and the L2 cognitive tasks scores.

In conclusion, better understanding about the threshold level(s) in the second language has been obtained. The research findings of the present study suggest that the threshold level(s) in the second language is probably more relative than absolute.

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CHAPTER 1 INTRODUCTION

1.1 BACKGROUND

The medium of instruction has been a major source of educational controversy in Hong Kong for half a century. This controversy will continue unless justifiable solutions that satisfy the needs of the majority of the Hong Kong people have been discovered. The complicated nature of the issue is the result of various factors: socio-cultural, economic, political, pedagogical and technical (Llewellyn, Hancock, Kirst & Roeloffs, 1982; Tam, 1986). In fact, throughout the half century, more compromises than solutions have been sought.

In Hong Kong, there are two types of secondary schools: Chinese middle schools and Anglo-Chinese secondary schools, if we classify them in terms of the mediums of instruction. Since late 1950s, there has been a consistent decline in the percentage of the former, where all subjects except English are supposed to be taught in Chinese, the students' mother tongue. The decline persists even after the Chinese language became an official language in 1974. The proportion of students studying in these schools was 41 per cent in 1959, but just 9 per cent in 1987 (馮以浤 ,1989). Whereas,

increasing number of students study in the Anglo-Chinese secondary schools, where all subjects except Chinese language, Chinese history or Chinese literature are supposed to be taught in English. Entering the Anglo-Chinese secondary schools has mostly been considered as a direct way towards upward social mobility.

Contrary to many parents' expectation, the exposure to English in most of the Anglo-Chinese secondary schools is not as great as it should be. The trend is that "the confusing use of mixed code" (Education Department, 1989, p.24) prevails most of the classroom discourses. This is far from the ideal of genuine bilingual education. The average amount of English in oral instruction is 43 per cent, with very frequent code-switching between it and the other 48 per cent of Cantonese. The 9 per cent left is Cantonese utterances with English phrases inserted; the average frequency of code-switching is about one switch every 18 seconds (Johnson & Lee, 1987). Actually, there is a great range of differences according to students' abilities, form levels, prestige of schools, teachers' preference and types of lessons (Johnson & Lee, 1987). This breed of bilingual mixed code has been assumed by many schools and teachers as an inevitable compromise to cater for those kinds of students of low linguistic proficiency in English, not being allotted school places before the nine years' free and compulsory education instituted in 1978. The traditional sudden switch of the medium of instruction from Chinese to English in Form One,

as an even earlier compromise, is one of the sources of troubles. Most of the written presentation on the blackboards, in the textbooks, hand-outs, exercises/workbooks, tests and examinations are in English.

It is almost universally agreed that the mother tongue is the most natural and effective medium for learning and teaching for children, especially in monolingual societies. Also, in Hong Kong, opinions generally favour Chinese being used as the medium of instruction in the primary levels. In most primary schools in Hong Kong, all subjects except English are taught in Chinese.

However, there is a great controversy in Hong Kong over the medium of instruction for the secondary levels. The main reason is that the need to adapt to the local bilingual system at large is becoming increasingly urgent. The nearer barriers to overcome are the public examinations, which are critical for higher education and upward social mobility.

> "Equality of educational offerings --- and thus of opportunity to learn --- is a pre-condition if there is to be equitable selection by competitive examinations, particularly within compulsory education. Another prerequisite is equality of chances to demonstrate in those examinations what one has learnt." (Llewellyn et al., 1982, p.35)

Llewellyn et al. indicated the significance of language competence for fair social selection.

In addition, Brimer (1985b) had the opinion that teaching approach, texts and autonomous learning have all to be taken into consideration to ensure the least disturbance of learning. If any "learning" takes place, the use of English presentation and tests or examinations would only have reduced it to rote memorization; and inflexible methods have to be used in teaching (Education Department, 1989). Ho (賀國強 , 1986, 1989a) and Siu and Mak (蕭炳基 , 麥思源 , 1989) have found that the written presentation does have significant effect on academic achievement. According to them, the Chinese medium of instruction is more suitable for the average and under-average students, especially in subjects of relatively high language dependency such as Sciences and particularly Social Sciences. In addition, Johnson and Lee (1987) have found that the mode of questioning for assessment has significantly greater effect than the mode of presentation on experimental test scores.

Furthermore, Ho (賀國強 , 1986) and Siu and Mak (蕭炳基 , 麥思源 , 1989) have found that the use of English written presentation only is not helpful in improving students' linguistic proficiency in English. Therefore, in most cases, no genuine bilingual education exists in Hong Kong. Bilingual education has two major objectives: (1) to facilitate content learning comparable to education in the first language (L1), and (2) to facilitate high proficiency in both L1 and the second language (L2). The "mixed code" used in most of the

Anglo-Chinese secondary school classrooms does not facilitate either objective.

Some evidence has shown that even for élite students (the top 10-15 per cent), there are signs of underachievement in linguistic proficiency. Siu (蕭炳基 , 1986) has compared the élite students in Form Three of Hong Kong to those of Guangzhou and Singapore. Chinese and English verbal reasoning and usage were tested. Comparatively, those of Guangzhou were significantly better in Chinese and Singapore in English than those of Hong Kong. If it is the case for the Hong Kong top students, it is not incredible that most of the others in Hong Kong do not function well in either Chinese or English (Fu, 1987; Luk, 1989).

About 46 per cent of Form Three students in the Anglo-Chinese secondary schools preferred completely Cantonese oral instruction and about 30 per cent preferred Chinese written presentation (Johnson & Lee, 1987). But there is a small number of Primary Six students who would choose the Chinese middle schools. The figure in 1983 was 4.5 per cent (賀國強 , 1987). This figure perhaps reflects parental choice for English medium of instruction. But the students' preference mentioned above is probably a realistic response to the past three years' experience of failure in learning (see also Yu & Atkinson, 1988).

Nevertheless, in the same research, most of the others preferred "bilingual" oral instruction or written

presentation (Johnson & Lee, 1987). Probably, however ambivalent towards the two languages, they still retain various degrees of motivation to cope with the bilingual system at large. Despite the approach of 1997, the return to be a part of China, the expansion of involvement in the international arena will not necessarily exaggerate the importance of English but will perhaps retain the ambivalence of the students towards their L1.

Some estimations have been made about the proportion of Hong Kong secondary school students who may benefit from the English medium of instruction. It is generally around 20-30 per cent. Brimer (1985b) concluded in his research report that approximately only the top 30 per cent in language proficiency are able to receive instruction through English and answer test questions in that language.

Llewellyn et al. (1982) suggested that there be a gradual phasing in of bilingual education starting from Secondary One so that by the end of Secondary Three the students have about half of their instruction through each language.

Throughout the past half century, probably there is a tug of war going on between two extremely strong forces, shaping the use of the medium of instruction: one is pulling instituting English as the medium of instruction as early as possible, and the other as late as possible. Opinions usually vacillate between the secondary school levels. At this point, even to make a compromise is

difficult.

It is probably right for Hong Kong to decide how to provide effective bilingual education for her students of various levels of linguistic proficiency. The rigid division between Anglo-Chinese secondary schools and Chinese middle schools is certainly unnecessary. Perhaps we need a genuine bilingual education for the top students rather than that traditional English medium of instruction. And we need a less demanding bilingual education or Chinese medium of instruction for the majority of secondary school students. In general, a gradual phasing in of bilingual education on a subject by subject basis for all secondary school students is worth considering. As the Hong Kong Advanced Level Examination can be taken in the Chinese medium in and after 1992, such bilingual education will probably have a more optimistic future.

1.2 THE RESEARCH PROBLEM

One of the problems worth researching is the possibility of identifying the students who are capable of receiving education through L2. These students must have attained a threshold level in L2 required for a certain area and level of academic pursuit. It is expected that

they can benefit from both oral and written presentation in that language.

Presumably, to find the exact threshold(s) is difficult. It is, therefore, more practical to expect to determine the relatively exact level(s).

To understand "threshold level in the second language", we have to refer to Swain's (1986) article. First, it is a hypothesis. Second, it has not been determined. Third, it varies with age and subject material.

When we analyse this concept in the Hong Kong context, we may probably find some local researches very useful. It has been found that there are significantly different cognitive demands in terms of linguistic proficiency between academic subjects (賀國強 , 1986; 雷庭荪 , 1986; 蕭炳基 , 麥思源 , 1989).

In this research, it was hypothesized that if learners have attained a certain threshold level in L2, they will be able to accomplish certain cognitive tasks in that language. In addition, if learners' proficiency in L1 is high, they will have had greater potential for developing higher proficiency in L2.

The purpose of this research was to investigate the effect of bilingual proficiency on the achievement in cognitive tasks. Through the investigation of the relationship between them, the threshold level(s) may be determined.

One significance of the research lies in its

potential revelation of the different linguistic demands of individual types of cognitive tasks. The ultimate value of the study would lie in the connection with the arrangements within the whole bilingual education system that may be envisaged to be feasible for Hong Kong.

CHAPTER 2 LITERATURE REVIEW

Bilingualism is multidisciplinary. In this research, the theories and findings examined mainly come from four disciplines: applied linguistics, cognitive psychology, psycholinguistics and linguistics. It seems that these sources of knowledge in most cases complement each other and can contribute a lot of useful information for this research.

The nature of the problem chosen for research has limited the researcher to use a micro perspective. And in recent bilingual studies, Cummins has arisen as a prominent figure, his theories and models being generally accepted. Therefore, much of the first section in this review deals with detailed explanation of his hypotheses. However, at some points, we may find his concepts need much more clarification. Take, for example, cognitive/academic language proficiency (CALP). We may ask what the components of CALP are. As a result, wider exploration for related information is necessary. In this connection, the second section starts with the information processing models and semantic organization in the human memory and then seeks the relationship between cognitive and linguistic functioning. Finally, the significance of lexical knowledge in L2 acquisition and the conceptual proficiency in L1 are related.

Throughout, the relevance of the academic situation underlies the discussion as the problem concerns bilingual education.

2.1 BILINGUALISM AND THE THRESHOLD LEVEL(S) IN L2

Bilingualism

What is bilingualism? It is not easy to determine a generally accepted definition for it (Baetens Beardsmore, 1986). Therefore, we had better ask why it exists in our world. Indeed, bilingualism has become a part of our everyday life, and has great value in its use.

It is right to say that bilingualism stems from the human need to communicate alternately in more than one language. Through different sorts of communication, we can accomplish different sorts of tasks. It is not surprising that we often strive for bilingual proficiency.

To define "bilingual proficiency" practically may better clarify the assumptions aforementioned about the goal of achievement in the pursuit for bilingualism. We may define it as the different acceptable levels of ability to use two languages. If a certain level is too inadequate to accomplish any useful task, it is meaningless to set it as a goal of achievement. When the

level is higher and can fulfil some useful purposes, it is a kind of proficiency. Imagine that we put bilingual proficiency in a two-dimensional continuum (cf. Paradis, 1986), with the minimum acceptable levels at one end, and the native-like mastery of each language at the other. In fact, we do need some people to perform native-like bilingual proficiency.

Bilingual Education and Learning

> "Research suggests that one of the best ways of learning a second language is not to take occasional lessons, private instructions, expensive audiotape courses, and concentrated study, but to become immersed in the language." (Lefrancois, 1988, p.155)

Language immersion refers to entering an environment where only the target language is spoken.

Therefore, bilingual education has been used as a means to attain bilingual proficiency. Theoretically, it increases exposure to L2. Usually, about half of the school time is devoted to teaching content subjects in L1 and the rest in L2.

There are generally two major goals in bilingual education:

> "One major goal is --- as with any educational program --- that the students learn the substance of what is being taught. The second major goal is that the students learn at least one language other than their first one." (Swain, 1986, p.1)

It is expected that through bilingual education learners can attain high levels of bilingual proficiency without sacrificing academic achievement.

Learning even through L1 involves very complex tasks. It is not surprising if many educationists argue that L1 is the best medium of instruction. Recognizing the complexity of the acts of learning may well be the starting point for understanding the problem about the choice of the medium of instruction (see Figure 2.11). The questions concerning bilingual education should be considered within the framework of learning in general. Today, cognitive psychologists would also analyse learning within the information processing models of human memory.

The greater advantage of bilingual education lies in the formally maximized exposure to L2, which supposedly leads to high bilingual proficiency, so valued by societies as well as individuals. Theoretically, everyone is able to benefit from bilingual education on condition that he/she has attained the threshold level(s) in L2 (Swain, 1986). However, according to Swain,

> "... what defines a threshold level is not known, and ... furthermore, it will vary with age of the learner and the subject material being taught." (p.5)

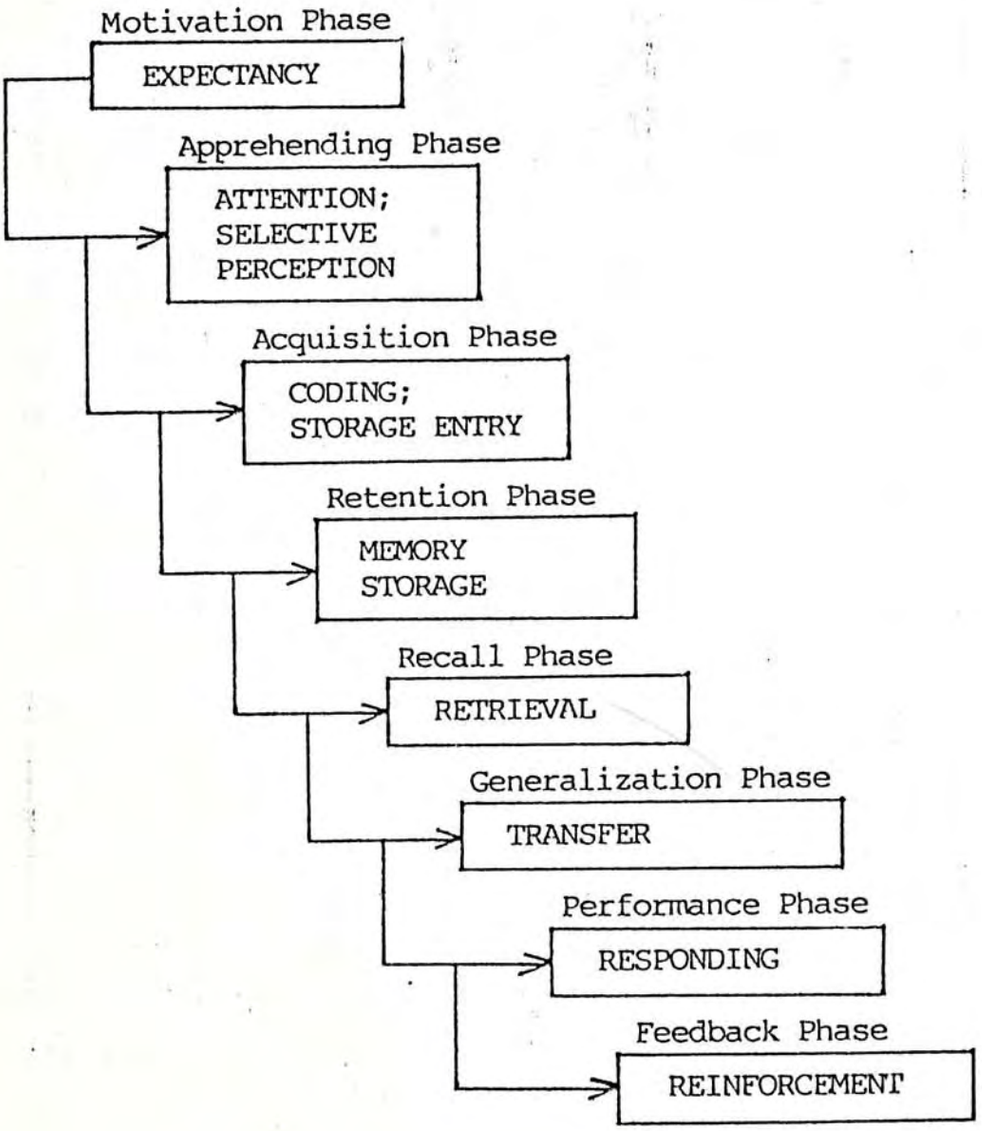

FIGURE 2.11 An Act of Learning: The Phases And Processes (Robert M. Gagné, 1974, Cited in Lefrancois, 1988, p.116)

The Academic Context and Communication

The ways of communication in the academic situation are different from ordinary social interactions, which people encounter outside the classroom (Carroll, 1986).

In the classrooms, teachers are taken for granted to execute the learning activities in order to accomplish some pre-determined instructional objectives. Students, therefore, are supposed to comply to the teachers' task structure and to respond to their questionings. Usually, it is the teachers who lead and allocate the conversational turns and interactions (Carroll, 1986). As a result, it is right to say that negotiation of meaning is much more restricted.

Language is the predominant means of instruction in the academic situation (Carroll, 1986). This schooled language deals primarily with ideas and is a tool for thought (see also Dunlop, Titone, Takala, Schrand, Lucas, Steele, Shohamy, Allen, Olshtain, Spolsky, Krashen & Bralystok, 1985). That is, the functions of language differ from those in ordinary social interactions, which are mostly interpersonal. The ideational functions are especially typified by the textbooks. And the teachers' role is in between. On the one hand, some interpersonal interactions are natural; on the other hand, the teachers "present a textbooklike view of the subject matter" (Carroll, 1986, p.364). The content of the teachers' speech is mainly factual, and their language is formal

(Carroll, 1986).

According to Cook-Gumperz and Gumperz (1982, cited in Carroll, 1986), the language used in the academic situation is decontextualized. It means that there is little or no relationship between the language and immediate environment. In other words, there is little support from real-world contexts.

For reading the textbooks and other written material, students have to attain proficiency in reading-specific skills. These skills include word identification skills and lexical access. As soon as the students can manage them, they can apply to reading many of the general comprehension skills acquired in the acquisition of oral language in L1. These general comprehension skills include extracting the meaning of a sentence, interpretation, inference, and metacognitive strategies. Finally, students also have to learn how to recall the written discourse. (Carroll, 1986)

It is clear, then, that the nature of language proficiency required by the academic situation is very different from that by ordinary interpersonal communication.

To sum up the points suggested, the threshold level(s) in L2 for the entry into bilingual education, therefore, has to be understood according to the demands of the academic situation. It is not unusual that students learning in L2 are compared with those learning in L1 at the grade-appropriate levels of academic

achievement. However, the additional difficulties confronting students learning in L2 are perhaps mainly listening skills in L2 including decoding, lexical access and parsing, probably being reflected in reading if the students have been trained for both types of skills (see also Samuels, 1987).

The Effects of Bilingualism

Before 1960s, there was generally a negative opinion towards bilingualism because there seemed to be detrimental effects on bilinguals' linguistic, cognitive and psychological functionings. More systematic research findings in 1920s-1960s tended to support this opinion. However, the researches have been criticized that they have methodological weaknesses and that the background variables are not controlled (Williams, 1967, cited in Oksaar, 1989; Peal & Lambert, 1962, cited in Appel & Muysken, 1987).

Most recent studies have demonstrated the positive effects of bilingualism. The St. Lambert experiment reported by Lambert and Tucker in 1972 (Ambert & Melendez, 1985) is one of the typical examples of successful early L2 immersion programmes for the majority language students in Canada. In addition, there are findings supporting the positive view that wherever the students' L1 is maintained and respected, as in the cases of minority language

students in various countries, there can be beneficial effects of bilingualism (Cummins & Swain, 1986).

In fact, both positive and negative effects have been found in researches, which is now generally accepted by the scholars in the field of study. What is more significant is that bilingual proficiency has been hypothesized as an intervening variable (Appel & Muysken, 1987) mediating the influence of social factors such as the prestige of the two languages, the socio-economic status of the bilingual and his/her ethnic community, and the educational situation.

Additive and Subtractive Bilingualism

The distinction between additive and subtractive bilingualism by Lambert in 1974, adopted by Cummins in 1979, may best conceptualize the two different types of bilingual learning experience that lead to the positive or negative effects of bilingualism for the individuals.

Additive bilingualism is the adding of a second language without any threat of L1 being replaced. In the case of majority language children in the Canadian studies, the L1 is a prestigious language and is supported by the environment outside school. Therefore, its development is maintained and the children's learning experience is enriched with the adding of a second language. According to Cummins (1989b), additive

bilingualism does not produce negative consequences in linguistic functioning, cognitive functioning or academic achievement.

Subtractive bilingualism, on the other hand, involves a language loss in L1. The acquisition of L2 does not bring about enrichment but instead causes prolonged negligence of L1 development, usually resulting in low levels of linguistic functioning in both L1 and L2, cognitive functioning and academic achievement. This is exemplified by the learning experience in the monolingual educational programs in L2 or the transitional bilingual educational programs for the minority language children (Ambert & Melendez, 1985).

The Threshold Hypothesis

Cummins has also adopted Toukomaa and Skutnabb-Kangas' idea about the threshold hypothesis (Cummins, 1987).

> "The threshold hypothesis proposes that there may be threshold levels of linguistic proficiency that bilingual children must attain in order to avoid cognitive disadvantages and to allow the potentially beneficial aspects of becoming bilingual to influence cognitive growth." (Cummins, 1987, pp.59-60)

That is, Cummins further theorizes on the cognitive effects of different types of bilingualism (see Figure 2.12).

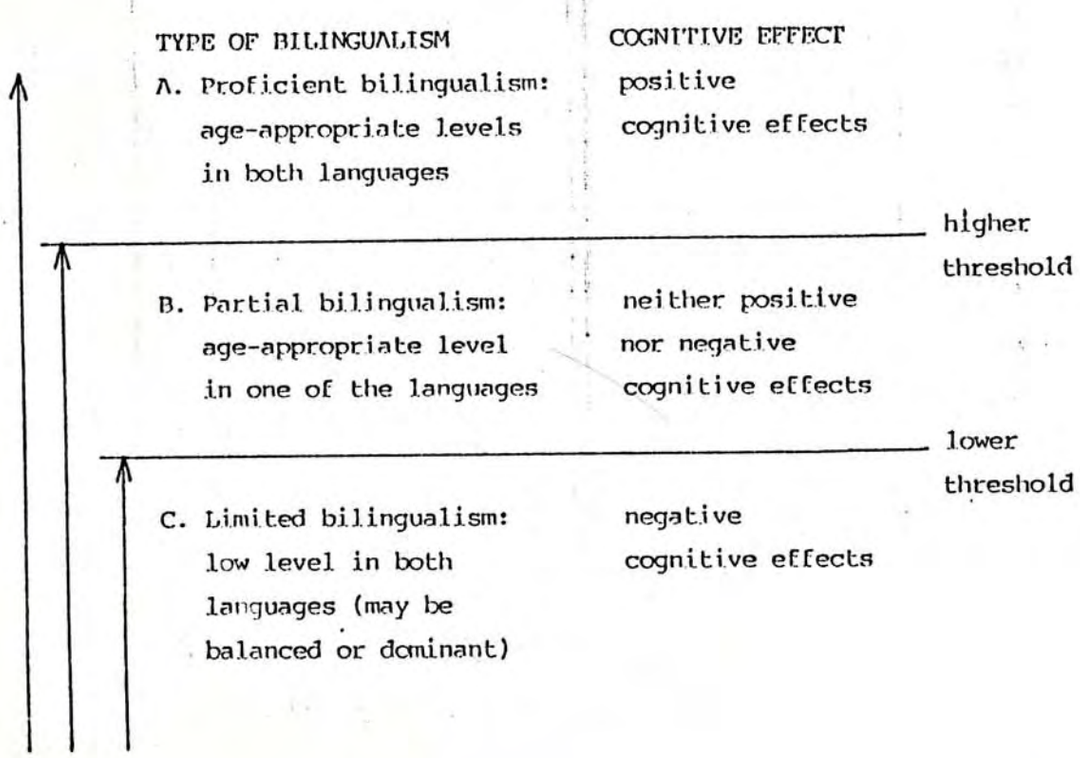

FIGURE 2.12 Cognitive Effects of Different Types of Bilingualism (Adapted from Toukomaa & Skutnabb-Kangas, 1977, Cited in Cummins, 1987)

Both positive and negative cognitive effects are long-term consequences of the different levels of bilingual proficiency. Subtractive bilingualism produces low levels of both L1 and L2, resulting in negative cognitive effects. At or beyond the lower threshold level of bilingual proficiency, there are no negative consequences, and that is just the minimal result of additive bilingual enrichment (Cummins, 1989b). At or beyond the higher threshold level, positive cognitive effects can be obtained.

Research findings have proved that bilinguals of high linguistic proficiency have greater development in metalinguistic awareness, cognitive flexibility and nonverbal intelligence than monolinguals. Hakuta and Diaz in a longitudinal study reported in 1985 that bilingualism has causal effect on cognition (Appel & Muysken, 1987).

According to Cummins, the higher or the lower threshold levels cannot be defined in absolute terms, because they vary with the individual's stage of cognitive development (1984; cf. 1987) as well as with the linguistic and cognitive demands of the tasks (1984; see also Swain, 1986). It is true that Cummins has only described the relationship between L1 and L2, being not yet able to give any quantitative examples for threshold levels in either L1 or L2.

The Interdependence Hypothesis

The threshold hypothesis is supplemented by the developmental interdependence hypothesis (Cummins, 1979, cited in Ambert & Melendez, 1985). The developmental nature of bilingual proficiency is conceptualized in the relationship between L1 and L2. It is hypothesized that L2 proficiency is partially a function of L1 proficiency. That is, L2 proficiency is to a certain extent determined by the level of L1 proficiency when L2 acquisition begins. This is true for the non-simultaneous acquisition of two languages after the age of three.

In this framework, L1 conceptual proficiency is a universal predictor variable (Cummins & Swain, 1986). Then, the developmental interdependence hypothesis is reformulated by the CUP (common underlying proficiency) model of bilingual proficiency (see Figure 2.13). There are some aspects of linguistic proficiency that are cross-lingual or interdependent between two languages. According to Cummins and Swain (1986), these are literacy-related aspects.

Three major sources of evidence contribute to the CUP model: the results of bilingual education programs for majority and minority language students; older learners being able to acquire L2 more rapidly than younger learners; and the use of L1 in the home being beneficial to academic achievement.

What is cross-lingual is the conceptual and linguistic proficiency. It seems that in the CUP model "linguistic proficiency" always implies "conceptual

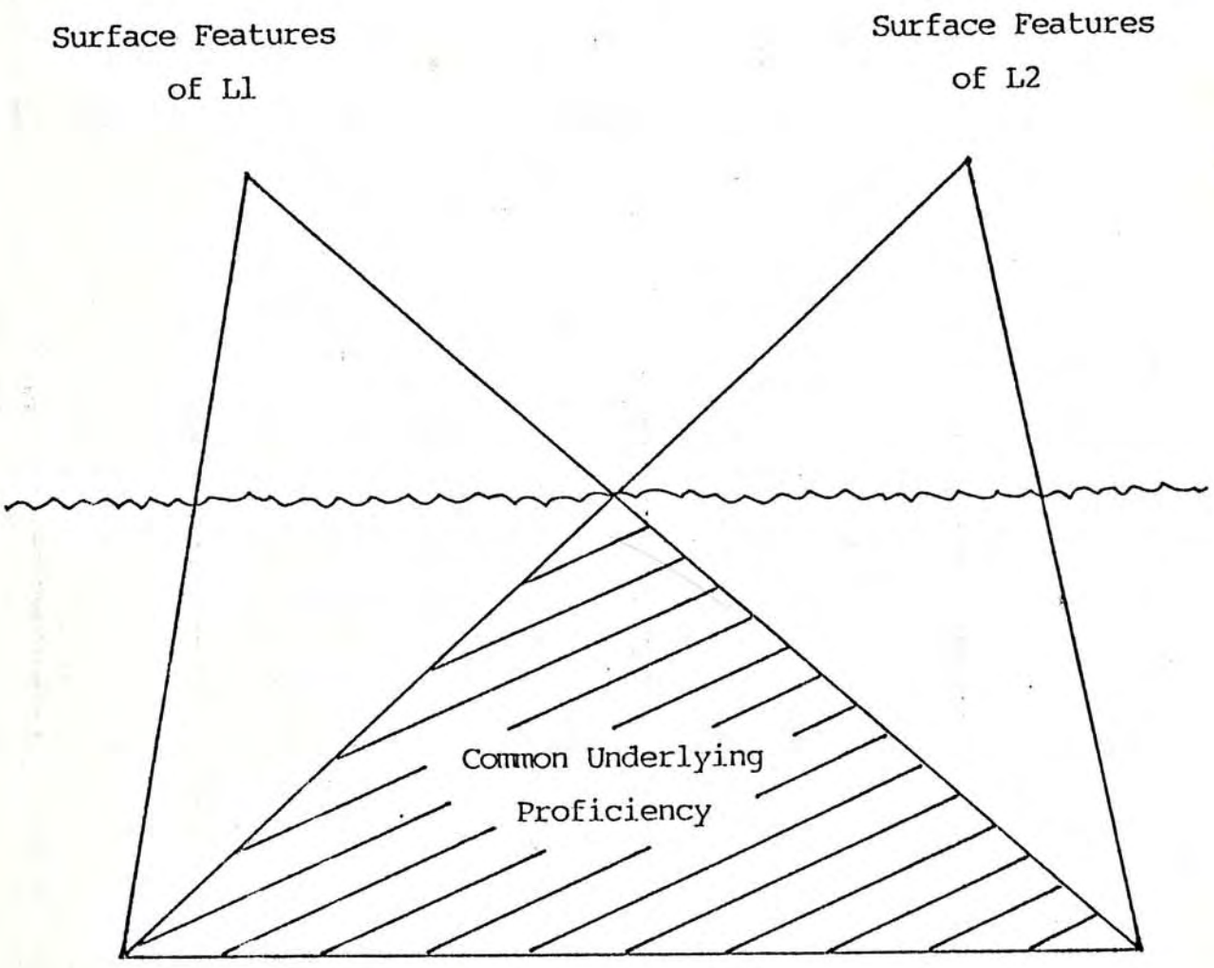

FIGURE 2.13 The Linguistic Interdependence Model (Cummins, 1989b)

proficiency". It may well be that the performance of linguistic proficiency is the manifestation of the underlying conceptual proficiency, which, being cross-lingual, makes the transfer of L1 conceptual and linguistic proficiency to L2 possible. This linguistic proficiency is also called cognitive/academic language proficiency (CALP).

The Cognitive/Academic Language Proficiency (CALP)

CALP is differentiated from BICS. The latter is basic interpersonal communicative skills, a linguistic proficiency for face-to-face communication, or ordinary social interaction. Whereas CALP is required in context-reduced situations (cf. Bruner, Olson or Donaldson, cited in Cummins & Swain, 1986). CALP also greatly depends on the underlying conceptual proficiency, which is cross-lingual and transferable from L1 to L2 (Cummins, 1980).

In order to explain the developmental relationship between language proficiency and academic achievement, Cummins has developed a more comprehensive theoretical framework, in which language proficiency is viewed along two continua: the range of contextual support and the degree of cognitive involvement (Cummins, 1984) (see Figure 2.14).

In context-embedded communication, the focus is on the negotiation of meaning, relying on situational and

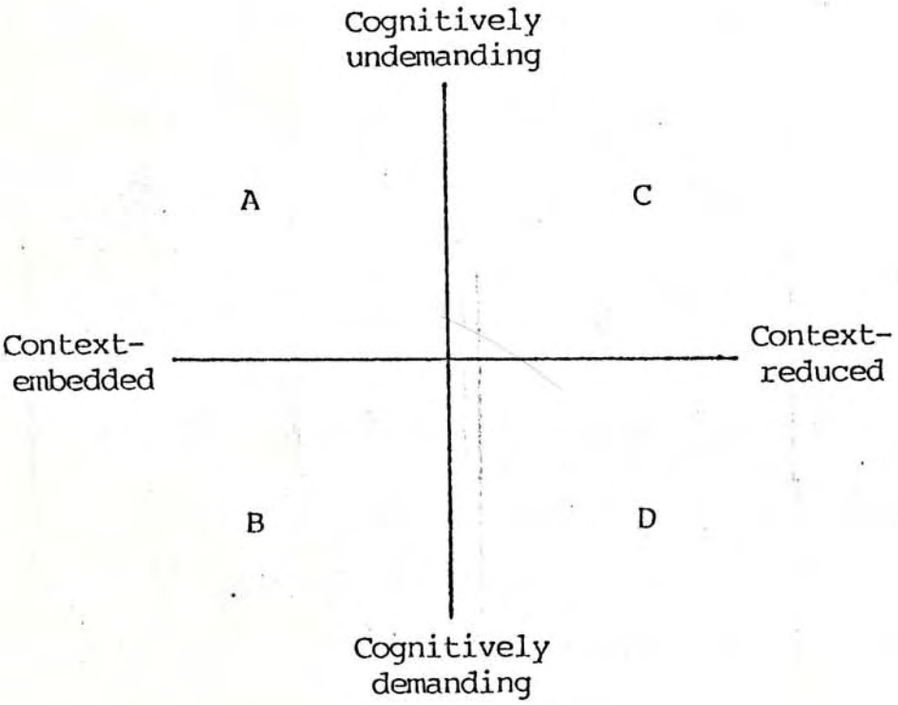

FIGURE 2.14 Range of Contextual Support And Degree of Cognitive Involvement in Communicative Activities (Cummins & Swain, 1986, p.153)

paralinguistic cues. Whereas in context-reduced communication, meaning relies mainly on linguistic cues and the logic expressed through them.

Cognitive involvement refers to the degree of automaticity in processing the information by the individual. Language proficiency is here viewed in a developmental perspective. A linguistic task that is cognitively demanding initially can become cognitively undemanding, probably through natural cognitive growth or through practice or exposure to similar tasks (cf. Cummins, 1987).

According to Cummins and Swain (1986),

> "Academic performance and ability to perform more cognitively demanding, context-reduced language tasks are positively related." (p.205)

It is true that the academic situation is context-reduced (see also Carroll, 1986). The academic situation is also cognitively demanding because the acts of learning are complex cognitive activities, through the processes of comprehension and abstract reasoning (Robert M. Gagné, 1974, cited in Lefrancois, 1988). In the researcher's opinion, it is probable that these activities compete with the linguistic functioning for human memory resources.

The linguistic interdependence between L1 and L2 makes the transfer of the conceptual proficiency from L1 to L2 possible. This transfer includes certain cognitive functioning as well as literacy-related skills. Probably,

cognitive functioning refers to concept formation and the establishment of the relations among the concepts (Solso, 1988); while literacy-related skills include reading skills (cf. Carroll, 1986). To summarize, this is a transfer of both knowledge and skills in the development of L2 (Cummins & Swain, 1986). Finally, the attainment of a high level of CALP can automatize the linguistic functioning and thus reserve much of the human memory resources for comprehension and abstract reasoning.

However, it seems that the components of CALP are not explicitly analysed in Cummins' theory, and it is only hinted that lexical knowledge is important: "lexical knowledge continues to develop throughout schooling and is strongly related to academic performance." (Cummins & Swain, 1986, p.152) It is apt to say that the analysis of CALP is all-important for making valid language tests for evaluating a person's language proficiency for context-reduced, cognitively demanding tasks (refer to the second section of this chapter for further exploration).

Principles of Language Development and Bilingual Academic Achievement

Despite the contradictory research findings about the effects of bilingualism, Cummins and Swain as aforementioned have been able to integrate them and established useful theoretical frameworks. Also, Cummins

(1989b) has tried to summarize the research findings into three general principles of language development and bilingual academic achievement. These principles are (1) the additive bilingual enrichment principle, (2) the interdependence principle and (3) the interactive pedagogy principle.

According to the additive bilingual enrichment principle, bilingual learners gain one more language in addition to L1 without language loss of the latter and without negative consequences in cognitive functioning or academic achievement.

According to the interdependence principle, there is an underlying cognitive/academic proficiency that is cross-lingual, common across languages (see Figure 2.13). Therefore, transfer of L1 proficiency to L2 can occur. This is especially beneficial to minority language learners, who have to overcome socio-cultural obstacles. The principle implies that education through L1 does not hinder the learners' L2 development.

According to the interactive pedagogy principle, the most important function of language is meaningful communication and interaction, so to maintain comprehensible input in L2 and not just exposure is one of the most essential factors for L2 development.

The Threshold Level(s) in L2

It is right to argue that the hypothesis about the threshold level(s) in L2 is more directly underlain by the interactive pedagogy principle. At or beyond the threshold level(s) in L2, meaningful communication in education through L2 can occur. Then, content learning can take place. This is how motivation to learn through L2 can be maintained. Then, the use of L2 facilitates the development of a high level of L2 proficiency.

It is at or beyond the threshold level(s) in L2 that transfer of L1 conceptual and linguistic proficiency can best be facilitated in bilingual education. Probably, this is a subconscious process, because the individual's attention is concentrated on the message rather than the language (see also Dunlop et al., 1985). In this way, the linguistic interdependence between languages can best be exploited.

> "To the extent that instruction in Lx is effective in promoting proficiency in Lx, transfer of this proficiency to Ly will occur provided there is adequate exposure to Ly (either in school or environment) and adequate motivation to learn Ly." (Cummins, 1983, cited in Cummins, 1989b, p.22)

It can be said that it is the hypothesis about the threshold level(s) in L2 that implicitly unifies Cummins' three principles of language development and bilingual academic achievement.

2.2 THE SIGNIFICANCE OF LEXICAL KNOWLEDGE

The Information Processing Models

With the advent of the cognitive science about twenty years ago, the information processing models of human memory have been useful in explaining the acquisition of knowledge.

There are three structures in the models: (1) a sensory register, (2) a short-term memory and (3) a long-term memory. Transformation processes link these structures.

The sensory register receives a lot of information but holds them only for a very short time, just within a fraction of a second. When attention is specifically directed, pattern recognition results. This is perception. Perception is a meaningful organization of sensory data. The pattern becomes meaningful because background knowledge in the long-term memory has been retrieved to interpret the environment.

The short-term memory (STM) is limited both in capacity and duration. Only about seven units of information can be held for about ten seconds. However, chunking can increase the capacity for and rehearsal the

duration of information. However limited the STM is, all conscious mental work, or conscious thinking, is accomplished here. Integrative processes, or encoding, work on the information for storage in the long-term memory.

The long-term memory (LTM) is a permanent storage space for nearly unlimited amount of information. For future easier retrieval, information has to be well organized and stored close to relevant background knowledge.

In addition, there are metacognitive processes, which control the transformation processes through the structures, at least sometimes (E.D. Gagné, 1985). While cognition is knowing, metacognition is the knowing of knowing. When the human mind knows what it wants to know, it will regulate all its resources for knowing.

Semantic Organization

Semantic networks have been used to represent memory organization in the LTM, where the background knowledge is stored. In the network models, typically, there are a set of nodes (concepts) and links that relate these nodes. One of the most generally accepted variation is the spreading activation models, for example, the Collins and Loftus model (see Figure 2.21). It is important to note that in their model, both word knowledge and world

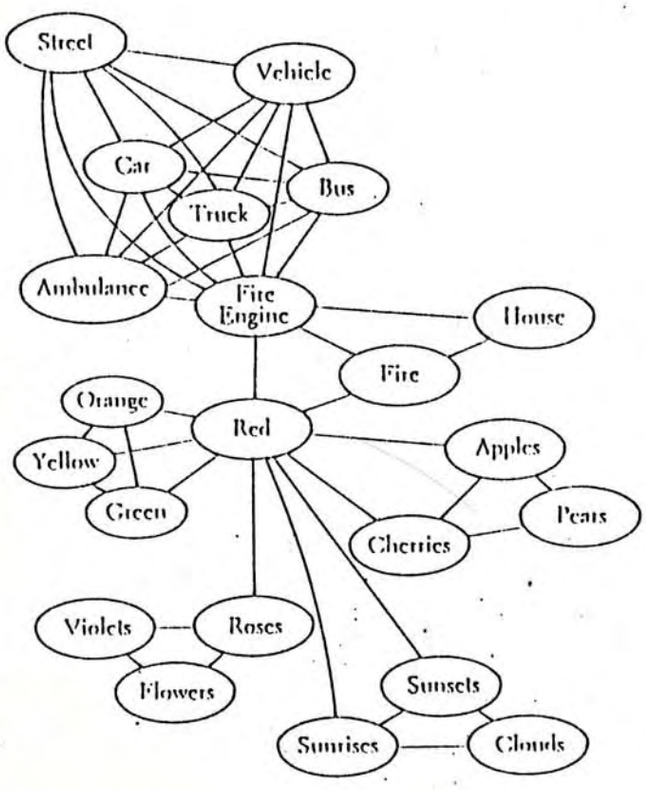

FIGURE 2.21 A Spreading Activation Model of Semantic Knowledge (Reproduced from Collins & Loftus, 1975, Cited in Carroll, 1986, p.158)

knowledge are integrated.

In the Collins and Loftus model, the nodes are interconnected, with the distance between them partly determined by hierarchical relations and partly by typicality in characteristics and the degree of association. Retrieval of concepts undergoes a process of spreading activation. Activation starts at a single node and spreads to its closely related nodes. And the effects weaken over distance. Therefore, some concepts are more easily and rapidly accessible than others. The most determining factors are frequency of usage and typicality (Carroll, 1986).

Some cognitive psychologists such as J.R. Anderson (1980), Lindsay and Norman (1972, cited in Solso, 1988) represented the same organization in propositional networks. There is not much difference between the two except that emphasis is put on different parts of the networks. Perhaps, the propositional networks are more realistic in representing factual knowledge, but they are not as flexible as the semantic networks.

Probably, the semantic networks are especially suitable for analysing the role of vocabulary. The meaning, or semantic content, of a word in one's mental lexicon is contained in such networks of concepts. As creativity is one of the major characteristics of the use of language, we may conjecture that there must be a high degree of flexibility in the organization of concepts within the networks. It is this flexibility that allows

the "unlimited" combinations of words in the finite set of syntactic structures. We may just hypothesize that if one's mental lexicon, or vocabulary size, is small, one's ability to manipulate the creativity of the language is low.

The Nature of Linguistic and Conceptual Functioning

It is probably very difficult to separate linguistic functioning from cognitive functioning. Some theorists argue that thought and language are originally independent in the individual, however, it is a fact that most people are exposed to language from birth onwards. And through the different stages of cognitive development (Piaget, 1980; and cited in Solso, 1988), the individual's cognitive functioning is increasingly dependent on abstract symbols like words. It is right to say that the impact of the integrated effort of cognitive and linguistic functioning is tremendous.

Chomsky (1980) is not exaggerating in stating that the human linguistic ability is the result of specie-specific mechanisms and thus genetically determined. It can be perceived that child L1 acquisition is accomplished with great ease and speed. Only such a genetically determining factor can endow people with the complex mental processes of cognitive and linguistic functioning underlying the seemingly effortless language behaviours.

Linguistic knowledge is mainly intuitive. Language behaviours reflect this underlying linguistic competence, whose components include: phonology, semantics, morphology, lexicon and syntax (Fromkin & Rodman, 1988). Language behaviours in reception and production are affected by the integration of these components. And the process of production is in essence a reversal of that of reception. Data from aphasic cases have revealed that:

> "the distinctions ... between syntax, semantics and phonology are not mere conceptual distinctions but relate in specifiable ways to the organization of the brain." (Carroll, 1986, p.74)

How the integration operates may partly be explained by the information processing models for language comprehension and production.

The psycholinguistics in the 1960s was mainly (1) rationalistic, emphasizing the biological foundation of linguistic functioning, (2) cognitive, emphasizing mental processes, and (3) structurally oriented, emphasizing a finite set of rules. Chomsky (1959, cited in Carroll, 1986; Chomsky, 1980), its pioneer, especially has pointed out the structure-dependency of sentences and the human creativity in comprehending and producing new sentences.

Emerging themes of psycholinguistics in the 1970s and early 1980s began to concentrate more on social context and language use, to question the cognitive specificity of linguistic functioning and to reach beyond the sentence recognizing the importance of discourse and lexicon.

Although modern perspectives prefer to view that the processes specific to language are underlain by some general cognitive processes (Carroll, 1986), it seems what, in the narrow sense, distinguishes linguistic functioning from cognitive functioning is the arbitrary nature of language. The relationship between form and meaning is arbitrary (see Figure 2.22). And that is why for the same concept, there can be different names, or labels, for it. Also, for the same relations among concepts, there can be different surface structures, or sentences. This is especially obvious when different languages are contrasted.

However arbitrary is the relationship between form and meaning, automatization of the corresponding low-level sub-skills can be particularly easy in L1 acquisition, can be done in L2 functioning, and is all-important for reserving a greater part of the limited STM resources for high-level cognitive and linguistic functioning (see also Samuels, 1987).

Interlingual Functioning

Most scholars concerned today agree that L1 and L2 acquisition and linguistic functioning are basically similar. For nonsimultaneous L2 acquisition by children, 86 per cent of the errors reflect normal developmental characteristics (Dulay & Burt, 1974, cited in Brown,

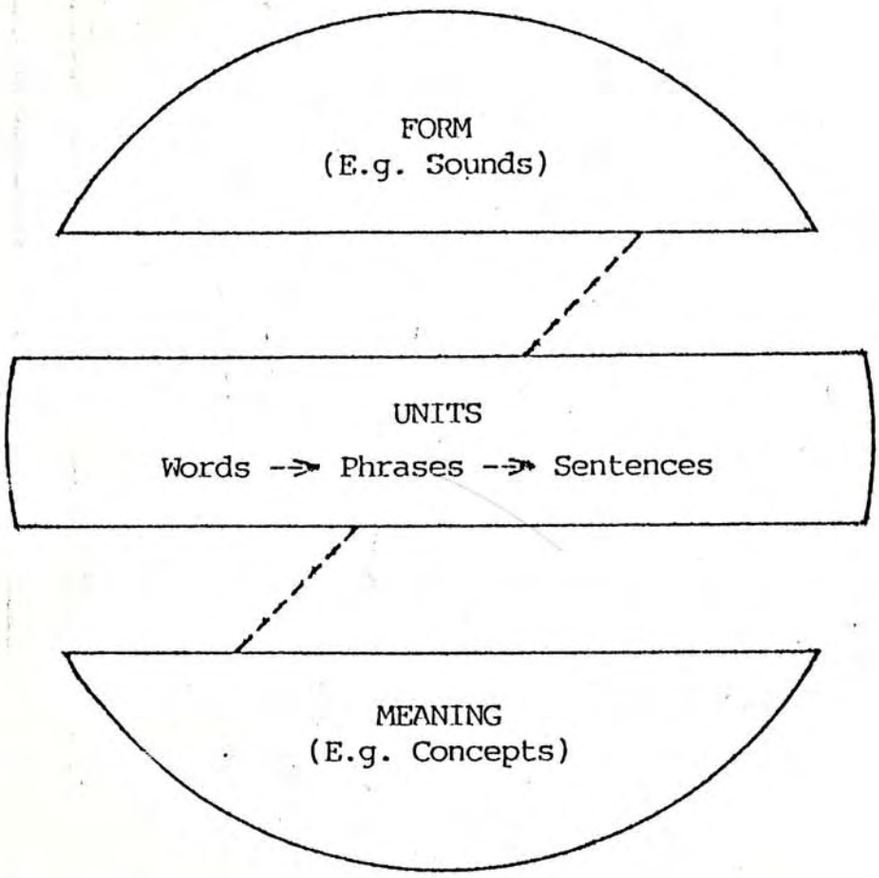

FIGURE 2.22 The Arbitrary Relationship between Form And Meaning in the Human Language System

1987). Nevertheless, there has not been much evidence about the semantic organization inside the bilingual brains.

Some neurolinguistic evidence has shown that different languages of the individual are represented very closely together (Paradis, 1977, cited in Appel & Muysken, 1987). Psycholinguistic studies have suggested that a bilingual has one semantic memory but two lexical stores.

> "It may ... be postulated that bilinguals possess one common conceptual system differentially organized depending on which language is used to verbalize a given experience, feeling, or idea." (Paradis, 1985, p.490)

What complicates L1 positive transfer in L2 acquisition is the fact that one word can have multiple meanings and that different languages are only partially overlapping (see also Macnamara, 1970, cited in Appel & Muysken, 1987). Just try to remember the arbitrary relationship between form and meaning, and to imagine the possible web of complex associations involved. Perhaps, to avoid L1 interference in the use of L2, automatization of the low-level subskills in L2 is essential in obviating the need for continual "translation" from L2 to L1 in reception or from L1 to L2 in production, in addition to the basic constraints of the limited memory resources.

Skilled Comprehension

For the academic situation, the acquisition of receptive skills is initially more important than that of productive ones. Receptive skills are acquired for comprehension. But even for these skills, some people are more proficient than others.

Most people have the potential to understand both spoken and written native language, provided that the topic is familiar. Here, it is assumed that they have an IQ level above 50 (Samuels, 1987).

However, there are distinctions between skilled and less-skilled readers even at college level (Townsend, Carrithers & Bever, 1987). The individual variation in the success of learning to read in L2 is much greater (Verhoeven, 1987). It has also been reported that the differences in listening in L1 are greater than reading in L1 (Townsend et al., 1987). Then, what actually can skilled comprehenders do? (See Figure 2.23)

There are two types of receptive skills: listening and reading. In most cases, the acquisition of listening skills precedes that of reading skills. In fact, reading skills build on listening skills. For listening, the relationship between sounds and meanings is direct. Literacy is not required (see Fromkin & Rodman, 1988). Matching is done directly through phonological associations. Therefore, there is no recoding. But for reading, matching and recoding in the decoding process are complementary. Matching in reading refers to the retrieval of the corresponding graphic image and recoding

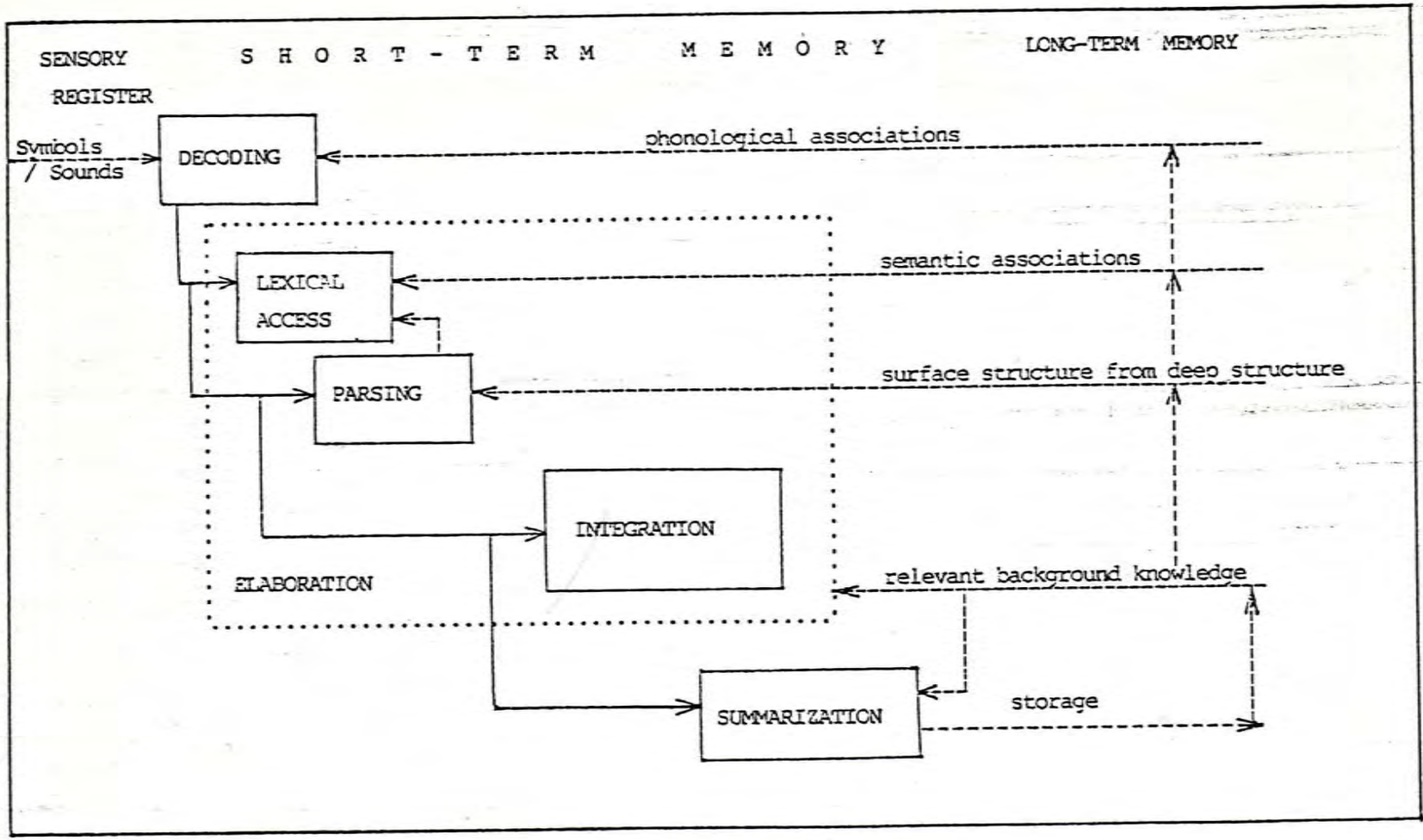

FIGURE 2.23 A Schematic Representation of Skilled Comprehension in the Human Memory

the phonological association for a word. Actually, recoding activates an alternate retrieval path for lexical access (cf. J. R. Anderson, 1980). But skilled readers usually, to a certain extent, can skip this step.

Then, for either listening or reading, the meaning(s) of each word input is identified during lexical access into the mental lexicon. A mental lexicon is an internal dictionary about the phonological shape, semantic content and syntactic properties of each word (Clark & Clark, 1977, cited in Appel & Muysken, 1987). The word as a linguistic cue continues to activate the relevant areas in the semantic networks while the immediate context in the sentence helps to identify the right meaning through confirmation.

Parsing inseparably intertwines with lexical access for literal comprehension. It determines the relationships among the words in a sentence. The surface structure is transformed into the deep structure, the meaning.

The activation of specific categories of background knowledge or what schema theorists call schemata, in the semantic or propositional networks, induces more systematic elaboration and reconstruction. This results in inference. For intersentential integration, inference is especially necessary. Skilled readers are more able to utilize the morphological and syntactic cues for integration (Townsend et al., 1987).

As the STM is limited in capacity, organization of

information through macroprocessing is necessary. This is the process of summarization, the building of a macrostructure, which is a set of propositions representing the main ideas (Kintsch & van Dijk, 1978, cited in E.D. Gagné, 1985). Storage of these organized ideas close to the relevant areas of background knowledge facilitates future retrieval.

Decoding, lexical access and parsing are low-level subskills. They are the foundation for high-level operations: understanding and/or abstract reasoning. For proficient high-level operations, both accuracy and automaticity in the low-level subskills are necessary.

Verbal/Linguistic and Conceptual Proficiency

> "A person's vocabulary size is one of the best predictors of other aspects of verbal ability. Vocabulary scores alone correlate .85 with full scores on the verbal portion of the Wechsler Adult Intelligence Scale." (Matarazzo, 1972, cited in Hunt, 1985, p.38)

Primarily, an individual's verbal ability is affected by his/her inherited intelligence (Weinberg, 1989; Samuels, 1987) as well as environmental factors such as socio-economic status on cognitive development and learning (cf. Hanushek, 1985; Cummins & Swain, 1986).

Specifically, verbal ability deals with symbols. The verbal portion of the intelligence tests probably reveals the past development of the knowledge structure through

the manipulation of symbols (cf. Pellegrino & Varnhagen, 1986). Paradoxically, as language is the most important means of instruction in the academic situation, academic achievement is greatly dependent on verbal ability.

It is probably right that vocabulary size, or lexical knowledge, reflects a person's "volume" of knowledge. It is because isolated new words cannot easily be memorized or accumulated. Learning isolated new words is not interesting either. Only storing word items close to the relevant areas of background knowledge can facilitate future retrieval in lexical access.

Vocabulary has direct relationship with lexical access, but it does not rule out the fact that it has effect on almost all cognitive processes for comprehension. The main reason probably is that the underlying conceptual or semantic memory is at work. Vocabulary serves as linguistic cues for the activation of relevant knowledge. In addition, some lexical items are useful cues for the integration of ideas in a discourse (Townsend et al., 1987).

For normal L1 adult speakers, their possession of the phonological and syntactic knowledge of their native language can always be assumed. This has mostly been achieved at around the age of six (Papalia & Olds, 1986). For English speakers, at this age the vocabulary size is about 2,500. And at the age of seven, it is about 3,000 and about 1,000 words per year are accumulated thereafter. It has also been estimated that average college seniors

have a vocabulary size of about 18,000-20,000 (Dale, 1965, cited in Hart, 1985). But what is significant is that there are personal variations in vocabulary size.

Most of us initially build the structure of knowledge with the native language. The personal variations in vocabulary size probably reflects the differential development in the structure of knowledge. That is, it is a reflection of past learning and achievement, and thus predictive of future learning and achievement (Pellegrino & Varnhagen, 1986).

Cummins and Swain (1986) have also suggested that lexical knowledge strongly affects academic performance. It is very probable that what Cummins and Swain call "conceptual proficiency" is at least an extremely important subset of the whole structure of knowledge. And the conceptual proficiency is the underlying resources for linguistic proficiency as referred to elsewhere in the previous section.

It seems that the significance of lexical knowledge is undeniable. However, isolated vocabulary is not very useful. What is more useful is lexical knowledge being integrated with some other skills. In the academic situation, literacy-related skills, especially reading skills, are the pre-requisite for effective and efficient learning and thus academic achievement. Among these skills, decoding, lexical access and parsing are fundamental and should be automatized. These are low-level skills, and their automatization can reserve greater

memory resources for high-level operations, such as understanding and abstract reasoning. To summarize, both lexical knowledge and literacy-related skills affect academic performance. And lexical knowledge can be a very useful indicator for linguistic proficiency, or verbal ability.

Linguistic Proficiency in L2

Conceptual proficiency and/including literacy-related skills in L1 are transferable in the acquisition of L2 proficiency. And this can be facilitated in bilingual education. However, the condition is that the learner's L1 is socially supported and the learner has attained the threshold level(s) in L2. As different subject material or cognitive tasks have different degrees of language-dependency, in order to make the aforementioned transfer possible, the learner has to attain the corresponding threshold level(s) in L2.

The threshold level(s) in L2 has to be conceptualized in terms of linguistic proficiency. In the academic or context-reduced situations, CALP is required (refer to the previous section). The components of CALP probably include graphonological, lexical and syntactic knowledge. But more important is their integration, in the form of skills, for example, in reading comprehension. The skills are similar in all languages but the arbitrary part of a

language is essentially linguistic.

To make comprehension or the acts of learning less cognitively demanding, the learner has to have automatized the low-level subskills: decoding, lexical access and parsing. There are evidences that slower processing in such skills in L2 affects cognitive functioning negatively (Macnamara, 1976).

Lexical knowledge has been found in Cooper's (1984) research on non-native readers of English to correlate at about .85 with comprehension and to have a greater effect than syntactic analysis, which correlate at .65. It is obvious the role of lexical knowledge, or vocabulary, is similarly significant in L1 and L2. And it predominates the CALP(s), which is a manifestation of the underlying conceptual proficiency. This conceptual proficiency is cross-lingual and thus transferable. It is realistically transferable from L1 to L2 only when it is integrated with the arbitrary part of L2. However, it seems that some re-organization in the semantic memory is needed because languages have only partially overlapping meanings for words. However, as long as an individual is motivated to make new associations in L2, the new system can be built up. Finally, what makes individual differences is the amount of lexical knowledge in L2, just as in L1 (see also Cooper, 1984).

2.3 A SYNTHESIS

The human advancement has greatly depended upon knowledge acquisition and accumulation, and the academic situation has long been the most formal for these. In the academic context, language is the predominant means of instruction. Therefore, the medium of instruction has become a matter of concern, especially in societies where bilingual proficiency is much valued.

Learning is complex in itself. Even in the individuals' L1, there are great personal variations in the capacity for knowledge. This has mostly been attributed to inherited intelligence, or cognitive potential, and to socio-economic status, which probably affects achievement motivation. But knowledge structure also affects cognitive development (Keil, 1984), which in turn affects the acquisition of knowledge. And it is likely that conceptual proficiency is related to cognitive development.

Verbal ability is a very important factor for academic achievement. This ability is related to the capacity for the manipulation of symbols or linguistic cues. Personal variations in verbal ability can be effectively predicted by the person's vocabulary size, which is probably a reflection of the underlying knowledge structure, which is organized in the form of semantic networks in the LTM. Lexical items are useful linguistic

cues for the retrieval of background knowledge and the related concepts.

As the relationship between the form and meaning of a language is arbitrary, the acquisition of the form is necessary for linguistic functioning. Isolated vocabulary is not very useful. But lexical knowledge being integrated with the fundamental phonological and syntactical knowledge as well as with the low-level subskills such as decoding, lexical access and parsing can have tremendous impact on understanding. In other words, the impact of lexical knowledge is mostly realized in discourses.

According to the interdependence hypothesis (Cummins & Swain, 1986), the L1 conceptual proficiency is cross-lingual and transferable in L2 acquisition. The literacy-related skills can also be transferred. However, many experiments have verified that socio-cultural factors affect the maintenance of L1 conceptual and thus linguistic proficiency.

To achieve the two major objectives of bilingual education: (1) effective content learning and (2) high bilingual proficiency, the learners have to attain certain threshold level(s) in L2. (It has to be stressed here that the higher and lower thresholds in Figure 2.12 are somewhat related but not exactly relevant to this research.) According to Swain (1986), the threshold level(s) varies with age and subject material. Therefore, it is a relative rather than an absolute level. In

essence, it is a hypothetical standard to be reached so as to facilitate meaningful communication and interaction. The interactive pedagogy principle (Cummins, 1989b) can explain this.

What is relevant to the academic situation is the context-reduced, cognitively demanding tasks. And what is required is the context-reduced, cognitively demanding linguistic proficiency. The CALP is context-reduced and its automatization will allow the linguistic functioning to become less cognitively demanding. The basic components of CALP probably include graphonological, lexical and syntactic knowledge. The integration of these components with literacy-related skills facilitates understanding in the academic situation or proper cognitive functioning in cognitive tasks. And the CALP is predominated by lexical knowledge. Finally, the threshold level(s) in L2 for the academic situation has to be conceptualized in terms of context-reduced, cognitively demanding linguistic proficiency.

For quick reference of the basic assumptions in relation to the research problem, Figure 2.31 provides a schematic representation.

2.4 THE THEORETICAL FRAMEWORK

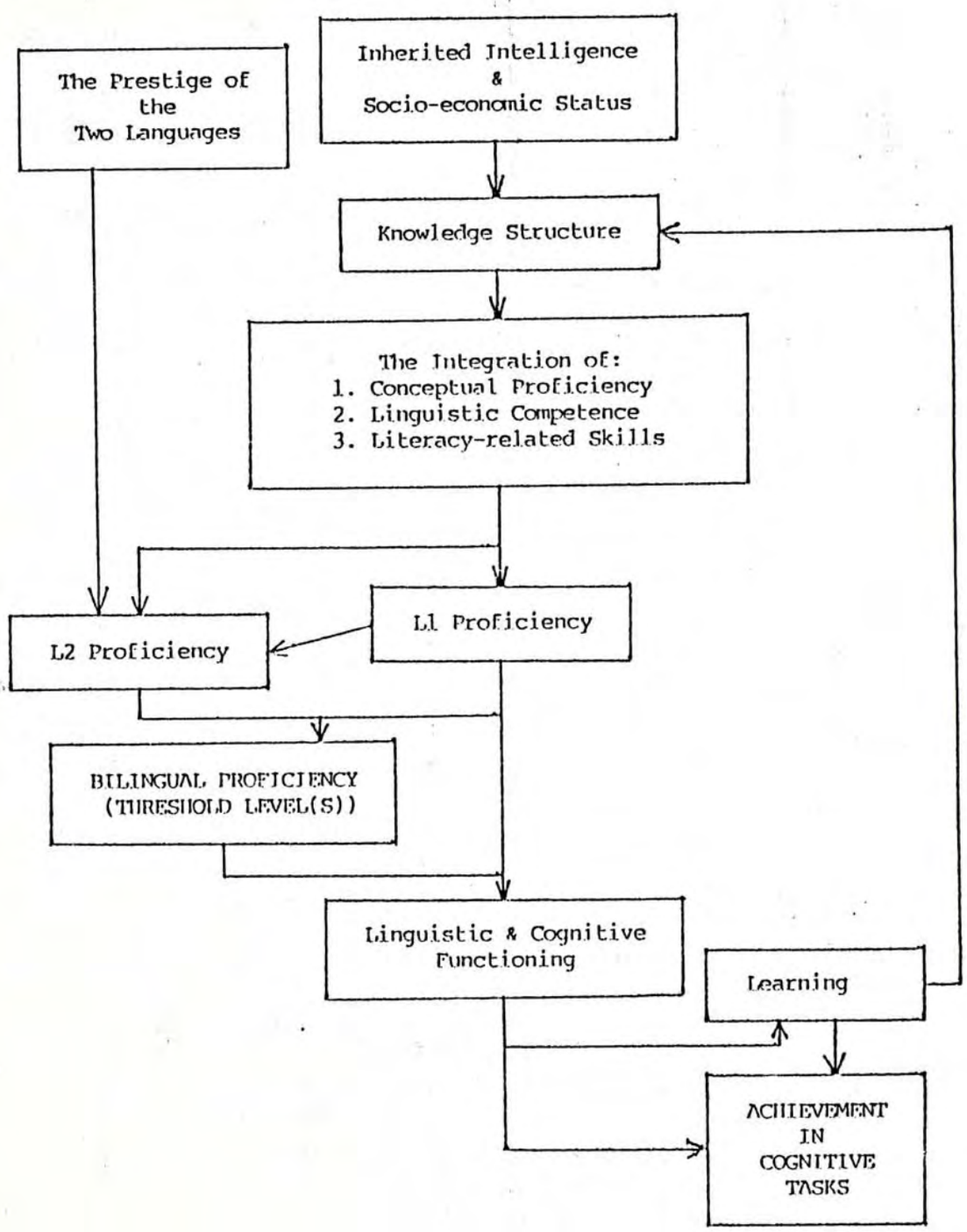

FIGURE 2.31 A Schematic Representation of the Basic Assumptions in Relation to the Research Problem

What facilitates effective content learning is understanding and proper cognitive functioning. Accordingly, the researcher attempted to choose two types of cognitive tasks: (1) summarization and (2) analogical reasoning. Summarization is related to inference in skilled comprehension (refer to the second section of this chapter). And analogical reasoning is regarded as a general ability underlying intellectual performance and the acquisition of knowledge (Armour-Thomas, 1986). As the research problem dealt with linguistic proficiency, these cognitive tasks were to be presented in verbal form.

The data about the achievement scores and finishing time for these cognitive tasks to be collected and analysed are believed by the researcher to reveal the individuals' understanding and cognitive functioning. However, the individuals' performance may be affected by the medium of assessment. More theoretically, this is related to the medium of instruction. And the immediate underlying factor is the individuals' bilingual proficiency, which may be conceptualized in a two-dimensional continuum, with the minimum acceptable levels at one end, and the native-like mastery of each language at the other (refer to the first section of this chapter).

The purpose of this research was to investigate the effect of bilingual proficiency on the achievement in cognitive tasks. In this connection, it was important to examine the interrelationship among the bilinguals' linguistic proficiency in L1 and L2, and the achievement

scores and finishing time in some cognitive tasks. For the academic situation, some relevant cognitive tasks as aforementioned were to be selected.

It was hoped that through this research, a better understanding of the threshold level(s) in L2 would be achieved. The major hypothesis in this research was that if individuals have attained a certain threshold level in L2, they will be able to accomplish certain cognitive tasks in that language.

CHAPTER 3 METHOD

3.1 IMPORTANT VARIABLES AND THEIR DEFINITIONS

The two important variables: (1) bilingual proficiency and (2) the achievement in cognitive tasks were to be operationalized and defined as follows:

Bilingual Proficiency

Bilingual proficiency was the independent variable. In Chapter 2, there had been some exploration about its nature. Bilingual proficiency can be defined as the different acceptable levels of ability to use two languages. There are personal variations among the bilinguals in bilingual proficiency. The reason is that the bilinguals may have differential development in the two languages.

According to the interdependence hypothesis, a bilingual's L1 and L2 have a common underlying proficiency, which is cross-lingual. It seems that this common underlying proficiency is not easily quantitatively definable. Contrariwise, it is more practicable to define L1 and L2 proficiency quantitatively in terms of

achievement scores in their respective language tests. And it is reasonable to consider the different combinations of L1 and L2 proficiency when bilingual proficiency is to be operationalized in definition.

In the present study, bilingual proficiency was operationalized as the different combinations in L1 and L2 proficiency in reading. Reading ability is especially relevant to the academic situation, more easily measurable in relation to the definition of the achievement in cognitive tasks and can theoretically reflect listening ability.

Achievement in Cognitive Tasks

The achievement in cognitive tasks was the dependent variable. It was considered in terms of achievement scores and finishing time. Achievement scores are the result of cognitive operations and finishing time is related to the degree of automaticity. In the present study, the achievement scores for the cognitive tasks, or the cognitive tasks scores, were marks obtained by the bilingual subjects in tackling the cognitive tasks and might be expressed as percent scores for any specific type of task. And finishing time was the subjects' self-reported records about the amount of time used in doing all of the items of the cognitive tasks in each language. It was counted in minutes.

3.2 HYPOTHESES

As there were two grade/academic levels in the present research, the hypotheses were applicable to both levels.

The Major Hypothesis

The major hypothesis was:

There is no difference in the achievement in the cognitive tasks through L2 among bilinguals of different combinations of bilingual proficiency.

The Minor Hypotheses

(1) There is no statistically significant correlation between L1 and L2 proficiency in reading.

(2) There is no statistically significant correlation between L2 proficiency in reading and listening.

(3) There is no statistically significant difference in the cognitive tasks scores through L1 or L2 among bilinguals of different combinations of bilingual proficiency.

(4) There is no statistically significant difference

in the finishing time for the cognitive tasks through L1 or L2 among bilinguals of different combinations of bilingual proficiency.

3.3 SUBJECTS

The population to be sampled was the Secondary One-Two and Three-Four students in Hong Kong. The Secondary Two and Four students did the cognitive tasks in April or May in 1991, but they took the language tests in the previous year. For convenience, in most cases the researcher called them Secondary Two and Four students. In short, two cohorts of secondary school students were sampled.

The present study was connected with a research project called "Educational and Social Determinants of Language Education Policy" (ESDOLEP) by the School of Education of the Chinese University of Hong Kong. In the present study, six secondary schools were selected from the larger samples of the project.

In the project, it was supposed that there are three ranks of secondary schools according to the students' bands, designated before the students were allotted places to Secondary One (Rank One consisted of the brightest students). The present study still used such division for

sampling the schools. Then, two secondary schools of each rank were selected. And two intact classes of each academic level were requested of each school by the researcher to participate but some schools had their own arrangement.

Among the subjects who did the cognitive tasks, 428 were Secondary Two and 445 were Secondary Four students. In the previous year, of the same six schools, 837 Secondary One and 744 Secondary Three students took the language tests especially made for their corresponding academic levels. The Hong Kong Identity Card numbers were matched with the computer. Finally, there were 218 Secondary Two and 221 Secondary Four students for the main part of data analysis.

3.4 INSTRUMENTATION

The Language Tests

Some norm-referenced language tests were used to assess the subjects' linguistic proficiency in L1 and L2. The subjects' reading ability in both L1 and L2 was measured. The ESDOLEP reading tests for Form One and Three, developed by the research team on the ESDOLEP Project, were used to measure the subjects' Chinese and

English proficiency in reading comprehension. In addition, the ESDOLEP English listening tests for Form One and Form Three were used to measure their English listening ability.

In the Form One language tests, there were 41 items in the Chinese reading test, 50 in the English reading test and 49 in the English listening test. In the Form Three language tests, there were 34 items in the Chinese reading test, 45 in the English reading test and 44 in the English listening test.

As the language tests were norm-referenced, appropriate to each grade level, it was expected that the variance among the subjects would be reasonably great. And for the present research, the reliability of these language tests was computed and was found to range from .75 to .92. (See Table 3.41)

The Cognitive Tasks

Another test called "Cognitive Tasks" was used to assess the subjects' mastery of the inferential comprehension and abstract reasoning tasks. The nature of the test was essentially criterion-referenced: To describe the subjects' performance in relation to a set of competencies, without much emphasis on comparisons among the subjects (see Hambleton, 1988).

The test items were devised by the researcher

TABLE 3.41

The Relevant Data about the Language Tests (Using the Six-Schooled Samples)

Language Tests	Mean	SD	Reliability (Alpha)
Form One: (N=837)			
Chinese Reading	24.76	7.57	.86
English Reading	25.88	10.67	.92
English Listening	25.00	8.76	.87
Form Three: (N=744)			
Chinese Reading	18.42	5.17	.75
English Reading	17.52	8.37	.88
English Listening	26.61	7.88	.87

herself. The content chosen was supposed to relate to the subjects' daily life. And the form was presented in written discourses.

There were two types of cognitive tasks: (1) summarization and (2) analogical reasoning. All together, there were 52 items, 26 for each type. Each item, within 50 words when it was in English, included a short paragraph, a yes-no question stem for that specific type of task and a statement demanding a yes-no answer. In the answer sheet, an additional choice for each item was allowed for those who wished to admit that they did not understand the paragraph. For the 26 items for each type of cognitive tasks, half was in English and the other half in Chinese. Therefore, as there were two types of cognitive tasks, there were still 26 items in either language. The researcher called the part in English as the English Version, and that in Chinese as the Chinese Version (but originally in the test, "Version" was termed as "Section"). For each version, the first two items were in fact practice questions for each type of cognitive task. As a result, there were 24 items in each version really useful for data analysis. At the bottom of each version, there was a blank for the subjects' self-reporting of their individual finishing time for all the items (26 items) in that version. Furthermore, the instructions for subjects were presented in Chinese, to make sure that the subjects were able to understand what they were requested to do. (See Appendix B)

For easier translation and control of vocabulary ranges, the tasks were first written in English. The Chinese items were in fact the translated version of the English ones, but the Chinese and the English versions were not completely identical in meaning. Only one half of each version was identical in content and concepts to that in the other language. The other half of each version was parallel in content to that in the other language. The purpose of such a device was to ensure the similarity of the two versions for comparing the language effect.

For each type of cognitive task in the English Version, there were two levels of vocabulary range: (1) 1,500 basic vocabulary and (2) 3,000 basic vocabulary. The vocabulary used was selected or checked and confirmed according to the word lists of Hill's (1985, 1986) series on word power. The writing of the English items mostly adhered to this principle. But for the Chinese items, the researcher just hoped that they were faithful translation in terms of concepts or deep structure.

To summarize, for final data analysis, there were 12 items for each type of cognitive tasks in each language. Among them, 6 were in 1,500 basic vocabulary range and the other 6 in 3,000 basic vocabulary range. In other words, there were 24 items for each language for data analysis.

For the English Version, the items were generally arranged from the easiest to the most difficult, according to the item analysis for the pilot tests. Each item of

the Chinese Version was then distributed to a position in the version quite different from that, identical or parallel, of the English Version. To complement the device for comparing the language effect, this was to ensure that the subjects treated each item relatively independently.

During final testing, unfortunately, it was discovered that Question (r) in the English Version had the question stem and answer statement missing. Finally, only the students of half of the school samples, one in each rank, had a real chance to do that question. Next, it was found that Question 14 and Question (t) were not identical as they should be.

Question (r) in the English Version and the corresponding Question 5 in the Chinese Version were finally deleted. Accordingly, there were 23 questions for each version during the main part of data analysis.

Reliability analysis was to be reported for these revised cognitive tasks. For the Secondary Two students, the alpha of the cognitive tasks in Chinese was .59 (N=428), and that in English was .64 (N=194). For the Secondary Four students, the alpha of the cognitive tasks in Chinese was .40 (N=445), and that in English was .49 (N=208). However, for criterion-referenced tests, there are some other equations for computing the reliability coefficients. In the present study, Livingston's $K^2(X,T)$ would be used (see Appendix D).

3.5 PROCEDURE

The data files of the language tests had been prepared by the ESDOLEP project before the matching of the Hong Kong Identity Card numbers in the present study. (Data collection was supervised and accomplished by the project in April, May or June, 1990.) And before the matching of the subjects who had participated in both the language tests and the test on the cognitive tasks, the researcher had to search for the six sampled schools from the data files.

The testing process of the cognitive tasks took place in April or May, 1991. The subjects had to finish both the Chinese and the English versions. To balance the effect of the order of the versions, one out of the two classes of each academic level of each school took the Chinese Version first and then the English Version, and the other class took the English Version first and then the Chinese one. Therefore, there had had to be some special arrangement in stapling and packaging. And some general instructions (see Appendix A) for the teachers responsible had had to be enclosed in the packages and the packages had been labelled of the order of administration of the versions. After the testing process and data entry for the cognitive tasks, the researcher matched the Hong Kong Identity Card numbers of the subjects. She entered

the matched subjects' achievement scores for the language tests into the data files for the cognitive tasks for the main part of data analysis.

When matching the subjects, it was found that nearly all of the subjects of one sampled Rank-Two school had their Hong Kong Identity Card numbers not available. This inevitably affects the sample size and the normal distribution of data in the main part of data analysis.

As a result, the groupings designed for the different combinations of bilingual proficiency had to be modified, different from the original plan. In the newer design, the subjects of each academic level were divided into four groups according to their levels of linguistic proficiency in L1 and L2 reading comprehension. The dividing lines were the values corresponding to the 50th percentiles of the achievement scores for the reading tests before the matching of the Hong Kong Identity Card numbers. Those who achieved marks greater than or equal to these medians in a language test would be labelled as "high", and the others who achieved less than the medians in the same test would be labelled as "low". To specify, there were four different combinations of bilingual proficiency:

(1) High in both Chinese and English (C=H,E=H)

(2) High in Chinese but low in English (C=H,E=L)

(3) Low in Chinese but high in English (C=L,E=H)

(4) Low in both Chinese and English (C=L,E=L)

For convenience, the abbreviations inside the brackets such as (C=H,E=H) might be used in the later sections of

this thesis.

CHAPTER 4 RESULTS

4.1 BILINGUAL PROFICIENCY

The Language Tests

After the matching of the Hong Kong Identity Card numbers, there were 218 Secondary Two and 221 Secondary Four students participating in the samples. And the mean scores for the language tests and therefore the reading tests became different from those presented in Table 3.41 (see Table 4.11)

The Different Combinations of Bilingual Proficiency

The subjects of each academic level were divided into four groups, basing on their levels of bilingual proficiency in terms of the scores for the reading tests in Chinese and English.

The dividing lines were the medians, the values corresponding to the 50th percentiles, of the scores for the reading tests before the matching of the Hong Kong Identity Card numbers. For the Secondary Two students (N=837), the dividing line for the reading test

TABLE 4.11

Mean Scores for the Reading Tests after the Matching of the Hong Kong Identity Card Numbers

Reading Test	N	Mean	SD
Secondary 2			
Chinese (CHIR)	218	23.86	7.68
English (ENGR)	218	24.45	10.98
Secondary 4			
Chinese (CHIR)	221	19.07	4.94
English (ENGR)	221	19.38	8.50

in Chinese (CHIR) was 26, and that for the reading test in English (ENGR) was 27. For the Secondary Four students (N=744), the dividing line for the reading test in Chinese (CHIR) was 19, and that for the reading test in English (ENGR) was 17.

Those whose scores were greater than or equal to the dividing line in a reading test were labelled as "high", and the others whose scores were lower than that line in the same test were labelled as "low" (see also Table 4.12). Finally, there were four groups of different combinations of bilingual proficiency in each academic level (see Table 4.13).

The Correlation between Chinese and English Reading

Pearson correlations were used to describe the relationship between Chinese (CHIR) and English (ENGR) reading comprehension. For the Secondary Two students, the correlation was .78, significant at the $p < .001$ level (N=218). The magnitude of the correlation was substantial. For the Secondary Four students, the correlation was .62, significant at the $p < .001$ level (N=221). The magnitude of the correlation was substantial. (See Table 4.14)

TABLE 4.12

Mean Scores for the Reading Tests of the "High" and "Low" Groups

Reading Test	n	Mean	SD
Secondary 2			
Chinese (CHIR)			
High	110	30.40	2.80
Low	108	17.19	4.77
English (ENGR)			
High	109	34.30	4.36
Low	109	14.60	5.23
Secondary 4			
Chinese (CHIR)			
High	133	22.30	2.56
Low	88	14.19	3.42
English (ENGR)			
High	130	25.17	5.76
Low	91	11.10	3.39

TABLE 4.13

Mean Scores for the Reading Tests of the Four Groups of Different Combinations of Bilingual Proficiency (BPG) in Each Academic Level

	Reading Test					
	Chinese (CHIR)			English (ENGR)		
BPG	n	Mean	SD	n	Mean	SD
Secondary 2						
C=H,E=H	92	30.66	2.77	92	34.91	4.29
C=H,E=L	18	29.06	2.65	18	19.11	6.67
C=L,E=H	17	22.29	2.62	17	31.00	3.20
C=L,E=L	91	16.24	4.48	91	13.70	4.42
Secondary 4						
C=H,E=H	103	22.70	2.60	103	26.04	5.73
C=H,E=L	30	20.93	1.91	30	13.17	2.44
C=L,E=H	27	15.52	3.34	27	21.85	4.61
C=L,E=L	61	13.61	3.32	61	10.08	3.34

TABLE 4.14

Pearson Correlations between the Tests

Secondary 2

	CTCR	CTER	CHIR	ENGR	ENGL
CTCR	1.00	.52***	.58***	.57***	.53***
CTER		1.00	.59***	.68***	.63***
CHIR			1.00	.78***	.74***
ENGR				1.00	.84***
ENGL					1.00

Secondary 4

	CTCR	CTER	CHIR	ENGR	ENGL
CTCR	1.00	.42***	.47***	.43***	.35***
CTER		1.00	.48***	.52***	.45***
CHIR			1.00	.62***	.49***
ENGR				1.00	.67***
ENGL					1.00

(*** denotes $p < .001$)

The Effect of Chinese Proficiency on the Scores in English Reading

One-way analyses of variance (ANOVA) were conducted to investigate the effect of Chinese proficiency in reading on the scores in English reading comprehension (ENGR). The subjects were differentiated into "high" and "low" in Chinese proficiency (CHIG). It was found that there were significant differences for both cohorts of students. For the Secondary Two students, significant difference was found at the $p < .001$ level, with $F = 240.09$ (N=218). For the Secondary Four students, significant difference was found at the $p < .001$ level, with $F = 92.40$ (N=221). The students who were "high" in Chinese had significantly higher scores in English reading than those students who were "low" in Chinese. (See also Table 4.15)

The Correlation between English Reading and Listening

Pearson correlations were used to describe the relationship between English reading (ENGR) and English listening (ENGL) comprehension. For the Secondary Two students, the correlation was .84, significant at the $p < .001$ level (N=218). The magnitude of the correlation was high. For the Secondary Four students, the correlation was .67, significant at the $p < .001$ level

TABLE 4.15

Mean Scores for English Proficiency in Reading (ENGR) of the "High" and "Low" Groups in Chinese Proficiency in Reading (CHIG)

CHIG	n	Mean	SD
Secondary 2			
High	110	32.33	7.54
Low	108	16.43	7.62
Secondary 4			
High	133	23.14	7.47
Low	88	13.69	6.62

(N=220). The magnitude of the correlation was substantial. (See Table 4.14)

4.2 THE COGNITIVE TASKS

The Specific Tasks

To inspect the nature of the cognitive tasks, factor analyses were performed to explore the possible number of factors underlying the task structure. The language factor was first precluded. Then, factor analyses were conducted on the scores of the test which was made of two types of cognitive tasks in two levels of vocabulary range. Finally, it was found that only one factor was underlying the test tasks, true for the two languages and academic levels.

When the two languages were considered, the mean was comparatively higher in the Chinese summarization (SM) task in the 3,000 basic vocabulary range, and comparatively lower in the English analogical reasoning (AR) task in 3,000 basic vocabulary range. This was true for the two academic levels.

The Language Effect on the Cognitive Tasks Scores

t-tests were used to test the difference between the correlated variances in the two different languages in terms of the achievement scores for the cognitive tasks (MARKC and MARKE, 24 items each).

For the Secondary Two students, significant difference was found at the $p < .001$ level, with $t = 13.10$ (N=194). And for the Secondary Four students, significant difference was found at the $p < .001$ level, with $t = 10.60$ (N=208). For both academic levels, the cognitive tasks scores in Chinese (MARKC) were significantly higher than those in English (MARKE). (Cf. Table 4.21)

Also, t-tests were used to test the difference between the correlated variances in the finishing time for the two language versions of the cognitive tasks (FTCS and FTES).

For the Secondary Two students, significant difference was found at the $p < .001$ level, with $t = -7.11$ (N=425). The finishing time for the English Version (FTES) was significantly longer than that for the Chinese Version (FTCS). But no significant difference was found for the finishing time for the two versions for the Secondary Four students. (Cf. Table 4.22)

The researcher attempted to see the language effect on finishing time within each rank in terms of student ability. t-tests were performed for the students of each rank of each academic level (see also Table 4.23).

For Secondary Two students, significant differences were found for the first two ranks. For both the Rank One

TABLE 4.21

Mean Achievement Scores for the Cognitive Tasks in Chinese and English

	Academic Level					
	Secondary 2			Secondary 4		
Cognitive Tasks	N	Mean	SD	N	Mean	SD
Chinese (24 Items:MARKC)	428	16.78	3.07	445	17.80	2.51
English (24 Items:MARKE)	194	13.70	3.70	208	15.83	3.00
Chinese (23 Items:CTCR)	428	16.11	2.99	445	17.14	2.35
English (23 Items:CTER)	428	13.32	3.43	445	14.77	2.82
Chinese (23 Items:CTCR) when the version was taken first	217	16.59	2.48	215	17.16	2.40
English (23 Items:CTER) when the version was taken first	211	12.72	3.41	230	14.51	2.84

TABLE 4.22

Mean Finishing Time for the Chinese (FTCS) and English (FTES) Versions (In Minutes, for 26 Items in Each Version)

	Academic Level					
	Secondary 2			Secondary 4		
Version	N	Mean	SD	N	Mean	SD
Chinese	428	11.86	3.32	430	12.20	3.21
English	425	13.46	4.14	426	12.55	3.45
Chinese when the version was taken first	217	11.98	2.67	212	13.08	3.28
English when the version was taken first	209	15.34	4.17	217	13.45	3.29

TABLE 4.23

Mean Finishing Time for the Chinese (FTCS) and English (FTES) Versions of Each Rank

	Rank					
	One		Two		Three	
Version	Mean	SD	Mean	SD	Mean	SD
Secondary 2						
Chinese	10.03	2.26	12.24	3.06	13.64	3.66
English	12.76	3.97	14.39	3.83	13.16	4.53
Secondary 4						
Chinese	12.46	3.83	11.57	2.79	12.61	2.61
English	12.02	3.52	12.18	3.33	13.77	3.23

students (t = -7.43, N = 152, p < .001) and the Rank Two students (t = -6.54, N = 155, p < .001), the t values were significant. That is, for the first two ranks, the finishing time for the English Version was significantly longer than that for the Chinese Version. But no significant difference was found for the Rank Three students (N=118).

On the contrary, for the Secondary Four students, no significant difference was found for the Rank One students (N=166). Yet significant differences were found for the lower two ranks. Significant values were obtained for the Rank Two students (t = -2.10, N = 142, p < .05) and the Rank Three students (t = -3.29, N = 116, p = .001). That is, for the lower two ranks, the finishing time for the English Version was significantly longer than that for the Chinese Version.

The Effect of Vocabulary Range on Subjects' Performance for the Tasks

t-tests were used to test the difference between the correlated variances in the achievement scores for the cognitive tasks in terms of the two different vocabulary ranges. First, the cognitive tasks in Chinese 1,500 basic vocabulary range (CVOF, 12 items) were compared to those in Chinese 3,000 basic vocabulary range (CVTH, 12 items) (see also Table 4.24).

TABLE 4.24

Mean Achievement Scores for the Cognitive Tasks in Chinese 1,500 Basic Vocabulary Range (CVOF) and Chinese 3,000 Basic Vocabulary Range (CVTH)

Vocabulary Range	N	Mean	SD
Secondary 2			
1,500	428	8.22	1.72
3,000	428	8.56	1.88
Secondary 4			
1,500	445	8.68	1.61
3,000	445	9.12	1.48

The statistical results were significant for both the Secondary Two students ($t = -3.66$, $N = 428$, $p < .001$) and the Secondary Four students ($t = -5.19$, $N = 445$, $p < .001$) For both academic levels, the achievement scores for the cognitive tasks in Chinese 3,000 basic vocabulary range were significantly higher than those in the Chinese 1,500 basic vocabulary range.

Also, the cognitive tasks in English 1,500 basic vocabulary range (EVOF, 12 items) were compared to those in English 3,000 basic vocabulary range (EVTH, 12 items) (see also Table 4.25).

For both the Secondary Two students (N=194) and the Secondary Four students (N=208), no significant difference was found between the achievement scores for the cognitive tasks in English 1,500 basic vocabulary range and those in English 3,000 basic vocabulary range.

Finally, the researcher attempted to examine the variations among the students of different ranks in the English cognitive tasks scores of the two different vocabulary ranges.

For the Secondary Two students, significant difference was found for the Rank Two students at the $p < .05$ level, with $t = 2.26$ (N=72). Their achievement scores for the cognitive tasks in English 1,500 basic vocabulary range were significantly higher than those in English 3,000 basic vocabulary range. But no significant differences were found for the Rank One students (N=71) or Rank Three students (N=51). (See also Table 4.26)

TABLE 4.25

Mean Achievement Scores for the Cognitive Tasks in English 1,500 Basic Vocabulary Range (EVOF) and English 3,000 Basic Vocabulary Range (EVTH)

Vocabulary Range	N	Mean	SD
Secondary 2			
1,500	194	6.99	2.04
3,000	194	6.71	2.15
Secondary 4			
1,500	208	7.89	1.76
3,000	208	7.94	1.87

TABLE 4.26

Mean Achievement Scores for the Cognitive Tasks in English 1,500 Basic Vocabulary Range (EVOF) and English 3,000 Basic Vocabulary Range (EVTH) for the Students of Different Ranks

	Rank					
	One		Two		Three	
Vocabulary Range	Mean	SD	Mean	SD	Mean	SD
Secondary 2						
1,500	8.09	1.28	7.24	1.67	5.10	2.08
3,000	8.01	1.67	6.71	1.58	4.90	2.17
Secondary 4						
1,500	8.47	1.46	7.86	1.68	6.74	1.93
3,000	8.59	1.55	8.14	1.71	6.24	1.78

For the Secondary Four students, no significant differences were found for either the Rank One (N=86), Rank Two (N=80) or Rank Three (N=42) students. Yet, for Rank Three students, the positive t-value indicated that comparatively higher achievement scores were obtained for the cognitive tasks in English 1,500 basic vocabulary range than those in English 3,000 basic vocabulary range. (See also Table 4.26)

The Effect of Academic Level and Rank on Cognitive Tasks Scores

Indeed, it had been assumed that some underlying cognitive factors might directly and/or indirectly be affecting the subjects' performance for the cognitive tasks. Here, academic level and rank were related to cognitive development. To test this assumption, the data of the two cohorts of students were juxtaposed for analysis. This time, the researcher conducted two-way analyses of variance (ANOVA), with academic level and rank as the classificatory variables, and with the Chinese cognitive tasks scores, the English cognitive tasks scores, the finishing time for the Chinese Version or the finishing time for the English Version as the dependent variables.

In the achievement scores for the cognitive tasks in Chinese (MARKC) (N=388), the main effect was significant

at the $p < .001$ level, with $F = 37.96$; the effect of academic level was significant at the $p < .001$ level, with $F = 19.57$; and the effect of rank was significant at the $p < .001$ level, with $F = 43.91$. There were two-way interactions at the .001 level, with $F = 7.45$. (See also Table 4.27)

In the achievement scores for the cognitive tasks in English (MARKE) (N=388), the main effect was significant at the $p < .001$ level, with $F = 90.07$; the effect of academic level was significant at the $p < .001$ level, with $F = 51.44$; and the effect of rank was significant at the $P < .001$ level, with $F = 101.76$. There were also two-way interactions at the $p < .01$ level, with $F = 4.93$. (See also Table 4.28)

In general, in the achievement scores for the cognitive tasks, the effect of rank was greater than that of academic level. The direction of interaction was that the Rank-One Secondary Four students performed best and the Rank-Three Secondary Two students obtained the lowest scores.

In the finishing time for the Chinese Version (FTCS) (N=388), the main effect was significant at the $p < .001$ level, with $F = 6.33$, the level effect being significant at the .01 level, with $F = 6.50$, and the rank effect at the .001 level, with $F = 6.80$. There were two-way interactions at the $p < .001$ level, with $F = 7.82$. (See also Table 4.29)

In the finishing time for the English Version (FTES)

TABLE 4.27

Mean Chinese Cognitive Tasks Scores (MARKC) As a Function of Academic Level and Rank (N=388)

	Rank					
	One		Two		Three	
Academic Level	Mean	SD	Mean	SD	Mean	SD
Two	18.49	2.07	16.69	2.71	14.20	3.23
Four	18.59	1.96	17.97	2.44	16.80	2.56

TABLE 4.28

Mean English Cognitive Tasks Scores (MARKE) As a Function of Academic Level and Rank (N=388)

	Rank					
	One		Two		Three	
Academic Level	Mean	SD	Mean	SD	Mean	SD
Two	16.10	2.29	13.94	2.58	10.06	3.74
Four	17.06	2.34	16.28	2.40	13.10	2.88

TABLE 4.29

Mean Finishing Time for the Chinese Version As a Function of Academic Level and Rank (N=388)

	Rank					
	One		Two		Three	
Academic Level	Mean	SD	Mean	SD	Mean	SD
Two	10.52	2.46	11.69	2.90	13.24	2.86
Four	12.51	3.24	11.99	2.47	12.44	2.46

(N=388), the main effect was significant at the $p < .001$ level, with $F = 6.32$, the level effect being significant at the $p < .01$ level, with $F = 9.11$, and the rank effect at the .01 level, with $F = 4.58$. There were also two-way interactions at the $p < .01$ level, with $F = 4.74$. (See also Table 4.210)

In general, for the finishing time, the magnitude of the effect of both academic level and rank was small. The direction of interaction was that the Rank-One and Rank-Two Secondary Four students took longer time to finish the Chinese Version but shorter for the English Version than those Secondary Two students of the same ranks. But this trend was reversed for the Rank-Three students.

The Direct Effect of Chinese Reading Proficiency on the Chinese Cognitive Tasks Scores

Stepwise multiple linear regressions were conducted to investigate the relative effect of Chinese (CHIR) and English (ENGR) proficiency in reading on the Chinese cognitive tasks scores (CTCR). Chinese proficiency was entered as the more important predictor, prior to English proficiency. This was true for both the Secondary Two and Four students (see also Table 4.211).

For the Secondary Two students, 37 per cent of the variance of the Chinese cognitive tasks scores could be explained by the variance of Chinese and English

TABLE 4.210

Mean Finishing Time for the English Version As a Function of Academic Level and Rank (N=388)

	Rank					
	One		Two		Three	
Academic Level	Mean	SD	Mean	SD	Mean	SD
Two	13.23	3.79	13.65	4.12	13.76	3.00
Four	12.55	3.20	11.28	2.83	14.12	3.41

TABLE 4.211

Stepwise Multiple Linear Regressions Showing Contribution of Chinese Reading Proficiency (CHIR) and English Reading Proficiency (ENGR) to the Chinese Cognitive Tasks Scores (CTCR)

	CTCR				
Independent Variable	B	Beta	F	df	R^2
Secondary 2					
CHIR	.14	.35***	110.91***	216	.34
ENGR	.09	.30***	64.29***	215	.37
Secondary 4					
CHIR	.17	.33***	60.91***	219	.22
ENGR	.06	.22**	35.72***	218	.25

** $p < .01$ *** $p < .001$

proficiency in reading combined. For the Secondary Four students, the percentage was 25. However, it is important to note that the factor of Chinese reading proficiency dominated the combined effect.

The Direct Effect of English Reading Proficiency on the English Cognitive Tasks Scores

Stepwise multiple linear regressions were conducted to investigate the relative effect of Chinese (CHIR) and English (ENGR) proficiency in reading on the English cognitive tasks scores (CTER). English proficiency was entered as the more important predictor, prior to Chinese proficiency. This was true for both the Secondary Two and Four students (see also Table 4.212).

For the Secondary Two students, 47 per cent of the variance of the English cognitive tasks scores could be explained by the variance of Chinese and English proficiency in reading combined. For the Secondary Four students, the percentage was 31. It is also important to note that the factor of English reading proficiency dominated the combined effect.

4.3 THE EFFECT OF BILINGUAL PROFICIENCY ON THE ACHIEVEMENT IN COGNITIVE TASKS

TABLE 4.212

Stepwise Multiple Linear Regressions Showing Contribution of Chinese Reading Proficiency (CHIR) and English Reading Proficiency (ENGR) to the English Cognitive Tasks Scores (CTER)

	CTER				
Independent Variable	B	Beta	F	df	R^2
Secondary 2					
ENGR	.18	.55***	181.27***	216	.46
CHIR	.07	.16*	93.88***	215	.47
Secondary 4					
ENGR	.12	.36***	81.79***	219	.27
CHIR	.15	.26***	49.65***	218	.31

* $p < .05$ ** $p < .01$ *** $p < .001$

The Effect of Bilingual Proficiency on the Achievement Scores for the Cognitive Tasks

One-way analyses of variance (ANOVA) were conducted to test the difference in cognitive tasks scores among bilinguals of different combinations of bilingual proficiency.

For Secondary Two students, statistically significant difference was found in the Chinese cognitive tasks scores (CTCR) at the $p < .001$ level, with $F = 33.41$. Those groups high in both Chinese and English, low in Chinese but high in English, and high in Chinese but low in English obtained significantly higher achievement scores than the group which was low in both Chinese and English. (See also Table 4.31)

Significant difference was also found in the Secondary Two students' English cognitive tasks scores (CTER) at the $p < .001$ level, with $F = 51.99$. The groups high in both Chinese and English, and low in Chinese but high in English obtained significantly higher achievement scores than the other two groups, which were low in English; and the group low in both languages had significantly lower scores than the other three groups. (See also Table 4.32)

For the Secondary Four students, significant difference was found in the Chinese cognitive tasks scores

TABLE 4.31

Mean Chinese Cognitive Tasks Scores (CTCR) for the Different Combinations of Bilingual Proficiency (BPG)

BPG	n	Mean	SD
Secondary 2			
C=H, E=H	92	17.60	2.17
C=H, E=L	18	16.56	2.55
C=L, E=H	17	16.71	2.11
C=L, E=L	91	13.80	3.07
Secondary 4			
C=H, E=H	103	18.33	1.92
C=H, E=L	30	17.67	1.52
C=L, E=H	27	17.33	2.18
C=L, E=L	61	15.43	2.83

TABLE 4.32

Mean English Cognitive Tasks Scores (CTER) for the Different Combinations of Bilingual Proficiency (BPG)

BPG	n	Mean	SD
Secondary 2			
C=H,E=H	92	15.27	2.25
C=H,E=L	18	12.50	2.81
C=L,E=H	17	14.59	2.40
C=L,E=L	91	10.36	3.15
Secondary 4			
C=H,E=H	103	16.36	1.97
C=H,E=L	30	13.80	2.66
C=L,E=H	27	14.82	1.69
C=L,E=L	61	12.89	2.94

(CTCR) at the $p < .001$ level, with $F = 22.64$. The group high in both Chinese and English obtained significantly higher achievement scores than those groups which were low in Chinese; and the group low in both languages had significantly lower scores than the other three groups. (See also Table 4.31)

Significant difference was also found in the Secondary Four students' English cognitive tasks scores (CTER) at the $p < .001$ level, with $F = 30.56$. The group high in both Chinese and English obtained significantly higher achievement scores than the other three groups; the group low in Chinese but high in English obtained significantly higher scores than the group low in both languages; and the two groups low in English had no significant difference in achievement scores. (See also Table 4.32)

The Effect of Bilingual Proficiency on the Finishing Time for the Cognitive Tasks

Also, to test the difference in the finishing time for the cognitive tasks among bilinguals of different combinations of bilingual proficiency, one-way analyses of variance (ANOVA) were conducted.

For Secondary Two students, statistically significant difference was found in the finishing time for the Chinese Version (FTCS) at the $p < .001$ level, with $F = 24.55$. The

group low in both languages was significantly slower than the other three groups; and the group high in Chinese but low in English was significantly slower than the group high in both Chinese and English. (See also Table 4.33)

However, no significant difference was found in the finishing time for the English Version (FTES) for the Secondary Two students. (See also Table 4.34)

For the Secondary Four students, significant difference was found in the finishing time for the Chinese Version (FTCS) at the $p < .05$ level, with $F = 3.57$. The group low in Chinese but high in English was significantly slower than the two groups which were high in Chinese. (See also Table 4.33)

Significant difference was found for the Secondary Four students in the finishing time for the English Version (FTES) at the $p < .05$ level, with $F = 2.78$. The group low in both languages was significantly slower than the group high in both languages. (See also Table 4.34)

4.4 THE ESTIMATION OF THE THRESHOLD LEVEL(S) IN L2

The threshold level(s) in L2 may be determined through the investigation of the effect of bilingual proficiency on the achievement in cognitive tasks. In the present research, the relationship between bilingual

TABLE 4.33

Mean Finishing Time (In Minutes) for the Chinese Version (FTCS) for the Different Combinations of Bilingual Proficiency (BPG)

BPG	n	Mean	SD
Secondary 2			
C=H,E=H	92	9.95	2.20
C=H,E=L	18	11.67	2.38
C=L,E=H	17	11.12	1.87
C=L,E=L	91	13.64	3.71
Secondary 4			
C=H,E=H	101	11.93	3.44
C=H,E=L	30	11.47	2.84
C=L,E=H	26	14.00	4.67
C=L,E=L	60	12.78	2.88

TABLE 4.34

Mean Finishing Time (In Minutes) for the English Version (FTES) for the Different Combinations of Bilingual Proficiency (BPG)

BPG	n	Mean	SD
Secondary 2			
C=H,E=H	92	12.40	4.07
C=H,E=L	18	14.72	3.32
C=L,E=H	17	11.41	3.41
C=L,E=L	90	13.10	4.42
Secondary 4			
C=H,E=H	100	11.56	3.45
C=H,E=L	30	12.93	3.31
C=L,E=H	26	12.23	4.47
C=L,E=L	59	13.10	3.34

proficiency and cognitive functioning in some relevant cognitive tasks was tested. This, in fact, was intended to link the realistic sequential relationship between: (1) linguistic proficiency, (2) cognitive functioning and (3) academic achievement (also refer to Figure 2.31).

There may be different approaches in the estimation of the threshold level(s) in L2. The logic the researcher adopts to estimate the threshold level(s) in L2 is based on the following three assumptions:

First, the students' cognitive functioning should best be assessed in their L1; and when the target population is whole cohorts of students, the mean L1 cognitive tasks score is usually referred to as the grade-appropriate level for the cognitive functioning the tasks purport to measure. Those who obtain such mean achievement score demonstrate that they can master cognitive functioning equivalent to the average students at the same grade. In other words, the grade-appropriate level is an indication of the normative standard of the grade cohort. It is assumed in this study that the grade-appropriate level is a criterion to which the satisfactory mastery of the cognitive functioning is inferred.

Second, if a bilingual can function in L2 as efficiently as in L1, his/her performance in the same type of cognitive tasks in the two language versions will be the same in terms of achievement scores. We would demand that the same grade-appropriate level should be reached on the L2 cognitive tasks test by the L2 learner if his/her

language proficiency in L2 would have been as good as in L1. If any level is expected or demanded of an L2 learner as the criterion performance in L2 cognitive functioning, we will accept the level equivalent to the grade-appropriate level on the L1 version of the tests. The grade-appropriate demand level, rather than grade-appropriate level, is used in this study to denote the criterion level demanded of an L2 learner in cognitive functioning. It is assumed, therefore, that the grade-appropriate demand level for L2 cognitive functioning can be determined on the basis of the grade-appropriate level on the L1 cognitive tasks test.

Third, the threshold level(s) in L2 is to be determined on an L2 language test scale which has predictive validity for cognitive functioning in L2. In other words, the estimation of the threshold level(s) in L2 is based on the fact that the grade-appropriate demand level for L2 cognitive functioning can be predicted reliably by the L2 proficiency test. In the present research, the correlation between the English reading proficiency and the English cognitive tasks scores was substantial or moderate (for Secondary Two students: $r = .68$; for Secondary Four students: $r = .52$). The predictive validity between the two was then established. The threshold level(s) in L2 which was assessed by the L2 reading proficiency test was to be related to the grade-appropriate demand level for L2 cognitive functioning. The estimation of the threshold level(s) in L2 was

accomplished by doing the corresponding regression calculation, on the basis of the correlations just mentioned above, back from the grade-appropriate demand level for L2 cognitive functioning. Finally, it is assumed that the students who have attained the threshold level(s) in L2 can probably achieve the grade-appropriate demand level for L2 cognitive functioning.

Basing on the assumptions mentioned above, some empirical data of the present research were utilized to illustrate the attempt to estimate the threshold level(s) in L2.

For the Secondary Two students, the mean Chinese cognitive tasks score (CTCR) was 16 marks; and for the Secondary Four students, it was 17 marks, one mark higher (see Table 4.41). As the target population was whole cohorts of students, these mean scores could rightly be the grade-appropriate levels for these cognitive tasks in Chinese (Chinese being the students' mother tongue). Those who could obtain marks equal to or higher than the respective grade-appropriate levels were supposed to be up to or better than the normative standards in cognitive functioning. Consequently, as L1 is the most natural and effective medium for assessment, the figures just mentioned above as grade-appropriate levels would be useful for discriminating masters from nonmasters for understanding and proper cognitive functioning.

Next, it is important to note that the cognitive tasks in the two language versions were at least parallel

TABLE 4.41

Mean Chinese Cognitive Tasks Scores (CTCR) As the Grade-Appropriate Levels (and Mean English Cognitive Tasks Scores (CTER) for Comparison)

	Academic Level					
	Secondary 2			Secondary 4		
Cognitive Tasks	N	Mean	SD	N	Mean	SD
CTCR (23 Items)	428	16.11	2.99	445	17.14	2.35
CTER (23 Items)	428	13.32	3.43	445	14.77	2.82

in content, which made the comparison of the language effect possible. In fact, some intrapersonal and interpersonal differences were reported in the previous sections. The adoption of the mean L1 cognitive tasks score as the grade-appropriate demand for proper cognitive functioning in L2 was then put into effect. The reality as shown in Table 4.42 was that although the cognitive demand was the same (precluding that of language) for the two language versions, the percentages of the subjects in the six-schooled samples who could satisfy such cognitive demand of the cognitive tasks differed considerably. The subjects performed much better in the cognitive tasks in L1 than in L2. These percentages were calculated with cumulative percentages from some relevant frequencies performed (see Appendix E, F, G and H).

The percentages of the students who could achieve the grade-appropriate level(s) or grade-appropriate demand level(s) for the cognitive tasks were estimated under the standard normal curve. Here, the z-scores were first calculated with the basic descriptive statistics for the six-schooled samples with about four hundred subjects in each cohort (with reference to Table 4.41). Then, the estimated percentages were derived from relevant statistical tables for standard normal distribution. Finally, it was estimated that for the cognitive tasks in English (CTER), only the top 22 per cent of both cohorts of secondary school students could achieve their respective levels (see Table 4.43).

TABLE 4.42

The Percentages of the Subjects in the Six-Schooled Samples Who Could Achieve the Grade-Appropriate Demand Level(s) (GADL) for the Cognitive Tasks

Cognitive Tasks	N	Raw Score of G A D L	Percent Score of G A D L	%
Secondary 2				
CTCR	428	16	.70	65.7
CTER	428	16	.70	29.0
Secondary 4				
CTCR	445	17	.74	65.4
CTER	445	17	.74	28.5

(For convenience of presentation, the Chinese grade-appropriate level(s) were incorporated temporarily into the GADL.)

TABLE 4.43

The Estimated Percentages of the Secondary School Students Who Could Achieve the Grade-Appropriate Demand Level(s) (GADL) for the Cognitive Tasks, Derived under the Standard Normal Curve (the z-Scores Calculated with Reference to Table 4.41)

Cognitive Tasks	z-Score of G A D L	%
Secondary 2		
CTCR	-.04	51.6
CTER	.78	21.8
Secondary 4		
CTCR	-.06	52.4
CTER	.79	21.5

(For convenience of presentation, the Chinese grade-appropriate level(s) were incorporated temporarily into the GADL.)

Then, an attempt was made to estimate the mean English reading scores by using the z-score(s) of the grade-appropriate demand level(s) for the English cognitive tasks (derived by calculation with the basic descriptive statistics in Table 4.44), and the relevant Pearson correlation coefficient(s), or standardized beta(s), established for this research (see Table 4.14). The estimated mean English reading scores could be represented in z-scores or raw-scores (raw-scores being derived with further calculation by using the basic descriptive statistics also in Table 4.44). (See Table 4.45).

The percent score(s) on the English reading test scale could be transformed from the respective raw-score(s) of the estimated mean English reading scores, just mentioned above. It was the result of the division of the raw score by the total number of items in the respective English reading test (see Chapter 3) (for results, see Table 4.45). In the framework of the present research, the threshold level(s) in L2 could be determined in terms of the percent score(s) on the L2 reading test scale.

To sum up, the procedure for the estimation of the threshold level(s) in L2 were divided into three steps:

(1) The decision to use the mean L1 cognitive tasks score as the grade-appropriate level for proper cognitive functioning;

TABLE 4.44

The Basic Descriptive Statistics for Further Calculation If Necessary

Test	Mean	SD
Secondary 2: (N=218)		
Chinese Reading (CHIR)	23.86	7.68
Cognitive Tasks in Chinese (CTCR)	15.86	3.14
English Reading (ENGR)	24.45	10.98
Cognitive Tasks in English (CTER)	12.94	3.55
Secondary 4: (N=221)		
Chinese Reading (CHIR)	19.07	4.94
Cognitive Tasks in Chinese (CTCR)	17.32	2.50
English Reading (ENGR)	19.38	8.50
Cognitive Tasks in English (CTER)	14.86	2.78

TABLE 4.45

The Tentative Percent Scores on the Reading Test Scale Transformed from the Estimated Mean Reading Scores

Reading Test	N	z-Score	Raw Score	Percent Score
Secondary 2				
CHIR	218	.03	24	.59
ENGR	218	.59	31	.62
Secondary 4				
CHIR	221	-.06	19	.56
ENGR	221	.40	23	.51

(2) The application of the L1 grade-appropriate level as the level for L2 grade-appropriate cognitive demand;

(3) The estimation of the raw score on the L2 reading test back from the grade-appropriate demand level for proper cognitive functioning in L2 mainly via regression calculation; with the conversion of the raw score into percent score as a specific threshold level in L2 on the L2 reading test scale.

CHAPTER 5 DISCUSSION

5.1 BILINGUAL PROFICIENCY

In the present research, bilingual proficiency was the independent variable. Pearson correlations were performed to describe the relationship between Chinese and English reading proficiency and their relationship was found to be substantially positive (for Secondary Two students, r = .78; and for Secondary Four students, r = .62). Equally substantially positive correlations had been found by other researchers (Brimer, 1985b; Johnson & Lee, 1987). Further through one-way analyses of variance (ANOVA), it was found that Chinese reading proficiency had effect on English reading proficiency. Such findings reveal the strong relationship between L1 and L2 proficiency.

The categorical division into different combinations of bilingual proficiency was in effect a strategy to organize the bilingual subjects' linguistic proficiency in L1 and L2 which had been measured on two separate language test scales into one workable construct which had theoretical basis and to serve the purpose of the present design. Bilingual proficiency as such was a construct developed in this study, basing on Cummins' linguistic

interdependence model (1989b), one of the influential theories in bilingual studies. The findings on the relationship between reading ability in the two languages, Chinese and English, were useful in helping to examine the hypothetical relationship between L1 and L2 proficiency in the local context.

Reading proficiency represented the literacy-related aspects of the conceptual proficiency; however, it is a fact that listening ability is relevant to classroom communication. Therefore, Pearson correlations were also performed to describe the relationship between English reading and listening. The relationship was found to be from substantially to highly positive (for Secondary Two students, $r = .84$; and for Secondary Four students, $r = .67$). The findings were useful because they probably reveal that English reading proficiency, to a great extent, reflects English listening proficiency. Such close relationship justifies the parsimonious use of the reading ability as the proficiency measure rather than both reading and listening.

5.2 THE NATURE OF THE COGNITIVE TASKS

The achievement in cognitive tasks was the dependent variable. Both achievement scores and finishing time were

considered. It was the criterion-referenced nature of the instrument that secured the underlying logic and procedures for the determination of the mastery level of the cognitive tasks as an indication of the threshold level(s) in L2.

In the present research, the cognitive tasks were made to aim at assessing the ability in inferential comprehension and abstract reasoning: Two very important areas of cognitive functioning in the academic context. Relatively stringent content specificity was set, especially in relation to the types of cognitive demand and the vocabulary ranges in English. In addition, the two language versions were constructed in parallel forms to tap the same areas of cognitive functioning.

It was originally expected that analogical reasoning would be much more difficult and cognitively demanding than inferential comprehension. But the factor analyses revealed that when the language factor was precluded, only one factor was underlying the tasks. It is meaningful then to treat the two types of tasks practically as a unified whole and relate them to the academic situation as some required context-reduced cognitively demanding tasks.

Vocabulary range as a variable affecting the task performance was manipulated. The findings from correlated t-tests showed that it had effect on the subjects' test scores. That the achievement scores for the cognitive tasks in Chinese 3,000 basic vocabulary range were significantly higher than those in Chinese 1,500 basic

vocabulary range suggests that the former was easier. The familiarity of the content might have affected the subjects' performance. However, this being easier could not be seen in the achievement scores for the cognitive tasks in English. Rather, the reverse was found for the Rank-Two Secondary Two students. In general, the English 3,000 basic vocabulary range was difficult for the secondary school students. Although it was difficult, it seems that some of the Rank-One Secondary Two and some of the Rank-One and Rank-Two Secondary Four students could manage. On the contrary, most of the Rank-Three Secondary Two students could not even manage the English 1,500 basic vocabulary range (see also Table 4.26). This suggests that the lexical knowledge in L2 is important in the development of English proficiency. This finding is in agreement with the results of previous studies (Cooper, 1984; Cummins & Swain, 1986; Matarazzo, 1972, cited in Hunt, 1985). And it is probably right to predict that the lexical knowledge in L2 is responsible for the academic achievement in language-loaded subjects in L2.

To sum up, as the cognitive tasks were presented in verbal discourses, the requirement for linguistic functioning was assumed. But linguistic functioning is also cognitive in nature (Cummins, 1984; Carroll, 1986). In addition to such communicative purpose of languages, the criterion-referenced nature of the cognitive tasks was designed to assess specific areas of cognitive functioning in relation to certain tasks. Therefore, the cognitive

demand was in fact more than linguistic.

5.3 THE EFFECT OF BILINGUAL PROFICIENCY ON THE ACHIEVEMENT IN COGNITIVE TASKS

There was statistically significant difference in the achievement in the cognitive tasks through L1 and L2 among bilinguals of different combinations of bilingual proficiency. Accordingly, the corresponding null hypotheses of the present study were rejected. This implies that there was significant effect of bilingual proficiency on the achievement in the cognitive tasks. The only exception existed in the finishing time for the cognitive tasks in English for the Secondary Two students.

The significant difference in the cognitive tasks scores through L1 among bilinguals of different combinations of bilingual proficiency can probably be attributed more to the bilinguals' facility in cognitive functioning, especially with those Secondary Four students who were high in both languages. And relatively inferior functioning was found in those students who were low in both languages, true for both academic levels. Surely, it could have been assumed that the linguistic requirement of the tasks in Chinese was very low. The maximum conceptual

requirement corresponded to the English 3,000 basic vocabulary range. Such a lexical level might even be regarded as too simple for the secondary school students. However, the demand in cognitive functioning of the tasks probably became relatively more important. The lack of homogeneity among the subjects in terms of achievement scores could probably be accounted for by their differential development in CALP (cognitive/academic language proficiency) (cf. Cummins, 1980) in Chinese. About 25-37 per cent of the variance of the Chinese cognitive tasks scores could be explained by the factor(s) of bilingual proficiency (with reference to the stepwise multiple linear regressions).

The significant difference in the finishing time for the cognitive tasks through L1 among bilinguals of different combinations of bilingual proficiency may also be accounted for by the level of CALP in Chinese. The pattern, however, was not very consistent with that of the Chinese cognitive tasks scores. Still, those Secondary Two students who were low in both languages did significantly more slowly than the other three groups, but this pattern was not found among the Secondary Four students. In general, it can only be said that certain differences existed among the groups in Secondary Four level. Therefore, it seems that only the results about the Secondary Two students could more reasonably be accounted for by the degree of automaticity in cognitive and linguistic functioning. Also, those who had better

command of the linguistic skills would demonstrate the higher level of automaticity. However, the significantly longer finishing time of the Secondary Four students who were low in Chinese but high in English might also be affected by relatively lower Chinese reading proficiency in comparison with those high in Chinese.

The performance in the cognitive tasks tests through L2 was also affected by bilingual proficiency. The two groups of each academic level who were high in English did better than those who were low in both languages. As the content and concepts of the cognitive tasks in the two languages were at least parallel, this different pattern could probably only be explained by the factor of English proficiency in reading. On the other hand, the Secondary Four students who were high in both Chinese and English had relatively superior development in English proficiency in reading and, therefore, significantly higher achievement scores for the tasks than the other three groups. In other words, these students were relatively more capable of understanding and reasoning through L2, at least within the English 3,000 basic vocabulary range. To sum up, the English cognitive tasks scores were directly affected by English proficiency in reading. This contention had been supported by the obviously dominant effect of English proficiency in reading, shown by the stepwise multiple linear regressions (for Secondary Two students, $R^2 = .46$; and for Secondary Four students, $R^2 = .27$). Probably, the development of CALP in English was

the underlying source contributing to these variances. However, the development of English reading proficiency might have partially been affected by the development of Chinese reading proficiency, as argued by the linguistic interdependence model: The conceptual proficiency is the underlying factor which is the essential constituent leading to the growth of bilingual proficiency.

For the Secondary Two students, the null hypothesis that there is no statistically significant difference in the finishing time for the cognitive tasks through L2 among bilinguals of different combinations of bilingual proficiency could not be rejected. In the finishing time for the English Version of the cognitive tasks, statistically significant difference was only found among the Secondary Four students. Again, significant difference obviously existed between those who were high and those who were low in both languages. The relatively superior English proficiency in understanding and reasoning of the Secondary Four students who were high in both Chinese and English was again demonstrated by their relatively faster finishing time. In tackling the cognitive tasks in English, these students probably had higher degree of automaticity in cognitive and linguistic functioning in addition to their relatively greater linguistic knowledge including lexical knowledge in L2. Whereas, the Secondary Two students who were high in both languages had not developed such degree of automaticity or level of linguistic knowledge in L2. Furthermore, it

might be conjectured that the Secondary Two students who were low in both languages had relatively low persistence in finishing the English cognitive tasks.

From literature review, it had been assumed that conceptual transfer between L1 and L2 can be functioning in the common underlying proficiency (CUP), which is cross-lingual. This is stressed in Cummins' linguistic interdependence model (1989b). In addition, from the perspective of cognitive science about the incorporation of newer information into the existing knowledge structure, or conceptual system, the notion of cross-lingual transfer in Cummins' bilingual theories can even be more understandable. What remains may probably be the question about the direction of transfer.

From the distribution of the subjects among the four combinations of bilingual proficiency, it can be seen that the majority of the students fell into the categories in which both L1 and L2 proficiency was either high or low, which is by no means coincidence. In fact, such phenomenon reveals the strong relationship between L1 and L2 in bilinguals. The Pearson correlations between the two substantiate such relationship.

When the time sequence of bilingual acquisition or learning is taken into consideration, the main direction of transfer may be viewed more vividly from the developmental perspective. In the Hong Kong context, English learning usually starts much later than Chinese acquisition, so it is more realistic that the students'

Chinese reading proficiency has been transferred in the development of their English reading proficiency than vice versa. The major point here is that for the Hong Kong bilingual students, English proficiency may partially be the result of conceptual transfer from the Chinese equivalents incorporated in the common underlying proficiency of the cognitive structure.

In the present research, what is most obvious is that in most cases there were significant differences between those who were high in both languages and those who were low in both languages in the achievement for the cognitive tasks. Both cognitive and linguistic functioning was required by the cognitive tasks. However, the effect of bilingual proficiency on the achievement in cognitive tasks was verified. And the differential performance of the two groups of bilingual proficiency combinations just mentioned implies the differential development of CALP, conceptualized in the linguistic interdependence model.

In addition to Cummins' model, Paradis' (1985) conception of the operations of the two linguistic systems can probably vividly describe the reality of bilingual proficiency: "One common conceptual system differentially organized depending on which language is used" (p.490). From findings mentioned elsewhere in the present study (stepwise multiple linear regressions), the dominant effect of a language on the cognitive tasks scores of its corresponding language version was evidenced.

In fact, the research findings in the main part of

data analysis suggest that the achievement in the English cognitive tasks was directly affected by English reading proficiency, especially revealed in the resulting patterns of the between-group analyses on the cognitive tasks scores of the two language versions. Those students who were high in English would probably have better performance in cognitive functioning in English than those who were low in English. Yet, in considering the strong relationship between L1 and L2 in bilingual proficiency in the local context, those students who were high in English would probably have had better development in Chinese reading proficiency than those who were low in English.

5.4 THE ESTIMATION OF THE THRESHOLD LEVEL(S) IN L2

The understanding about the nature of bilingual proficiency and its effect on the achievement in cognitive tasks is fundamental to the understanding and determining of the threshold level(s) in L2. However, it may also be assumed that monolinguals of different languages who have similar linguistic proficiency tend to perform similarly in culture-free cognitive tasks. This assumption can probably be applied to bilingual performance. If the bilingual has equal levels of linguistic proficiency in L1 and L2, his/her performance in the same type of cognitive

tasks in the two respective languages will be the same in terms of achievement scores. For achievement in a broader sense, the time factor relating to linguistic and cognitive functioning should also be taken into consideration. That is, the finishing time should be considered.

Yet, it is not unusual that individuals' L1 proficiency is higher than L2 proficiency, and therefore using norm-referenced language tests (on an interval scale) to testify the assumption above is not easy. On the contrary, to compare the achievement for relevant cognitive tasks in the two different languages may explicitly suggest the condition of the individuals' linguistic proficiency. Some correlated t-tests were performed to verify such intra-personal differences in the two languages, in terms of the achievement scores for the cognitive tasks and of finishing time. The findings suggest that in the Hong Kong context, the secondary school students' L1 proficiency is higher than L2 proficiency (see also Table 4.21, 4.22, 4.23). That is, such intra-personal differences in cognitive functioning with the two languages can be attributed to their personal differential development in L1 and L2.

Here, it is proposed that the standard setting procedure should be started with the criterion-referenced cognitive tasks, because only with such tasks can meaningful comparison be made, basing on the assumption about the monolinguals/bilinguals of similar linguistic

proficiency. This forms a part of the underlying logic for the estimation of the threshold level(s) in L2, which is contained in the theoretical framework for the causal relationship between bilingual proficiency and the achievement in cognitive tasks. However, the logic is not complete without the consideration of the relationship between L2 reading proficiency and L2 cognitive tasks scores.

In the present research, as the causal relationship between L2 proficiency in reading and the L2 cognitive tasks scores was established, the attempt for the determination of the threshold level(s) in L2 could be justified.

There was difference in the achievement in the cognitive tasks through L2 among bilinguals of different combinations of bilingual proficiency. This implies that there was significant effect of bilingual proficiency on the achievement in the cognitive tasks in L2. The direction of effect suggested by the research findings was that the higher L2 proficiency the students had, the more satisfactory achievement for the cognitive tasks in L2 they got. Therefore, it is reasonable to state that if individuals have attained a certain threshold level in L2, they will be able to accomplish certain cognitive tasks in that language.

The threshold level(s) in L2 is in essence a task-oriented standard designated on an L2 language test scale. In the academic situation, the threshold level(s) in L2 is

supposed to have predictive validity for satisfactory academic achievement in L2. In other words, academic achievement is the ultimate criterion. The predictive validity indicates the usefulness of the L2 language test scores in predicting academic achievement in L2 in the future. And the validity coefficient can be expressed in terms of a Pearson correlation.

In the present research, English proficiency in reading was the predictor variable and cognitive functioning revealed by the English cognitive tasks scores was the criterion variable. The performance in cognitive functioning had become in essence an intermediate criterion, reflecting general intellectual ability for academic achievement, within the 3,000 basic vocabulary range or conceptual demand.

There can be argument about how the standard should be set in relation to the threshold level(s) in L2. But in the present research, the researcher would first consider that the mean Chinese cognitive tasks scores could be a grade-appropriate level for reaching a satisfactory level of cognitive functioning. When such level was applied to the English cognitive tasks, it is still justifiable because students learning in L2 are frequently compared with those learning in L1 at the grade-appropriate levels of academic achievement. Take, for example, the Canadian studies on early L2 immersion (Cummins & Swain, 1986). That is, it was the adoption of the grade-appropriate level in L1 cognitive tasks to

reflect the grade-appropriate cognitive demand in L2.

Second, as the causal relationship between the cognitive tasks scores and bilingual proficiency had been demonstrated, the search for the standard as a reflection of the threshold level(s) in L2 on the basis of the L2 linguistic measure appeared to be legitimate.

Although this research had limitations to a certain extent in terms of sample size, normal distribution requirement and the discrepancy between the tests, it was an attempt to demonstrate the procedures for estimating the threshold level(s) in L2. Such estimation was by no means a violation of the direction of prediction in practical application, but an attempt to assess the threshold level(s) in L2 on the basis of a language test in L2. Further evaluation of the relevant findings will certainly substantiate this attempt.

It is quite reasonable to assume that the threshold level(s) in L2 will vary with grade levels (which to a certain extent reflecting age levels). Starting with the first step of the procedure, the researcher did find that the two academic levels had different mean Chinese cognitive tasks scores.

Yet, the percentages of the students who could achieve the respective grade-appropriate levels remained very stable across academic levels in the standard normal distribution. Under the standard normal curve, the estimated figures for the English cognitive tasks were 22 per cent for each of the two cohorts. These were

relatively consistent with other previous general estimations of 20-30 per cent (relatively formal estimation by Brimer in 1985 was 30 per cent). This further suggests that the establishment of the criterion in the cognitive tasks is useful. And in the present research, such percentages corresponded to interval scales, which are more suitable for the relatively accurate estimation.

For the Secondary Two students, the predictive validity of the English reading test was .68 ($p < .001$) for the criterion of cognitive functioning in English. And for the Secondary Four students, it was .52 ($p < .001$) (see Table 4.14). Though not substantially high, the validity coefficients as these could be quite acceptable by comparing to that of Scholastic Aptitude Test (SAT) scores with respect to college grade point average being .40 (Crocker & Algina, 1986). The predictive validity coefficients for the two academic levels were reasonably within the acceptable range.

To generalize the use of testing instruments in the present study, the percent scores were employed. There were at least three reasons. First, it can safely be used with norm-referenced measurements. Second, the percent scores allow comparison of students' linguistic ability among tests of the same language. Third, the threshold level(s) in L2 expressed in percent scores makes both large-scale and school-based testings possible and comparable.

5.5 QUESTIONS RELATED TO THE ESTIMATION OF THE THRESHOLD LEVEL(S) IN L2

In the present attempt to determine the threshold level(s) in L2, in fact, the researcher had to answer several underlying theoretical questions:

(1) What is the definition of the threshold level(s) in L2?
(2) What is the normative standard for proper cognitive functioning?
(3) Is the threshold level(s) in L2 relative in nature and if it is, why?

The Definition of the Threshold Level(s) in L2

As the threshold level(s) in L2 is a hypothesis (Swain, 1986), it may be worth testing. However, before testing, its definition becomes one of the most important questions to be answered.

In the present research, bilingual proficiency was to be defined first, basing on reviewed literature. It was conceptualized in a two-dimensional continuum and assessed

with two respective norm-referenced reading tests on interval scales.

The threshold level(s) in L2 was supposed to be a value on the interval scale for L2 reading proficiency. Actually, the threshold level(s) in L2 was automatically operationalized as a level of reading ability in L2. Surely the concept of the threshold level(s) in L2 does not exist in a vacuum. For example, in the academic situation, it is supposed to be related to academic achievement in L2. In the present research, it was related to cognitive functioning expressed in terms of the English cognitive tasks scores. In brief, it was related to some relevant context-reduced cognitively demanding tasks.

In essence, the threshold level(s) in L2 is an indicator for a certain acceptable level of L2 proficiency. The acceptability of something is subject to value judgement; the question is whether such value judgement is purely arbitrary opinion or more objectively a decision buttressed by reason and empirical data.

Probably, the threshold level(s) in L2 can further be defined and determined when it is task-oriented. And this task-oriented characteristic will perhaps prove itself to be useful in testifying the relative nature of the threshold level(s) in L2, as different tasks may have different linguistic and cognitive demand. However, such relative nature may best be quantified, compared and displayed on an L2 language test scale. Without such an

interval scale, the conceptual and linguistic demand of the different types of cognitive tasks cannot be compared. The scale is like a ruler.

Finally, the threshold level(s) in L2 can be defined as a task-oriented standard designated on an L2 language test scale.

The Normative Standard for Proper Cognitive Functioning

Another question relating to the determination of the threshold level(s) in L2 is: What is the normative standard for proper cognitive functioning for the tasks?

Suppose a task selected for testing is too easy or too difficult, so extreme that no variance can be found among the subjects. In such a case, although the task can be criterion-referenced and reflect the subjects' performance, the threshold level(s) in L2 can hardly be determined in relation to the task, because there is no way to set the minimum ability required for a task. Therefore, technically and strategically speaking, it is right to choose some relevant cognitive tasks that certainly cause some variance in the subjects' performance.

When the target-population is a whole cohort of students, the grade-appropriate level for the cognitive tasks in L1 is rightly a normative standard for proper cognitive functioning. Those who can achieve the grade-

appropriate level show that they function normatively in the cohort. And those who cannot are in fact lagging behind the norm.

It is axiomatic that L1 is the most natural and effective medium for learning and cognitive functioning. Therefore, the grade-appropriate level for the cognitive tasks in L1 can be an acceptable standard. And such a standard can equally be acceptable when it is applied to the cognitive tasks in L2.

Finally, the threshold level(s) in L2 can be estimated in relation to this grade-appropriate cognitive demand in L2 because the predictive validity of the L2 proficiency test in relation to the L2 cognitive tasks can have been established. Of course, it should be kept in mind that two kinds of standards have been mentioned. The threshold level(s) in L2 as a task-oriented standard is to be estimated. However, the standard for proper cognitive functioning on the L1 and L2 cognitive tasks test has to be determined first.

The Relative Nature of the Threshold Level(s) in L2

Hypothetically, the threshold level(s) in L2 is relative. It varies with age and subject material (Swain, 1986). In fact, Cummins (1979) has stated that the threshold levels vary with the individual's stage of cognitive development as well as with the linguistic and

cognitive demands of the tasks. The findings of the present research also suggest that the threshold level(s) in L2 is more relative than absolute, in agreement with Swain's and Cummins' theories.

The threshold level(s) in L2 was found to be relative at least from three points of view: (1) academic level, (2) lexical demand and (3) subject content. In connection with academic level, although there was no common testing instrument to compare the English proficiency of the two cohorts of subjects, their differential performance for the English cognitive tasks could imply this (see Table 4.28). In connection with lexical demand, the significance of lexical knowledge had been stressed in Chapter 2. Empirical data in intrapersonal differences affected by vocabulary range could prove that lexical demand is an important task variable, supporting the researcher's argument. And in connection with subject content, or topic, only some tentative statements could be made. More researches on this should be necessary.

Reasonably, the relative nature of the threshold level(s) in L2 with respect to different types of cognitive tasks can probably be an important area for future researches.

Furthermore, in real classroom situation, L2 listening in addition to L2 reading proficiency has to be taken into consideration. In the present research, mainly L2 reading proficiency was utilized for the determination of the threshold level(s) in L2, "certifying" the

subjects' capacity for proper cognitive functioning. Nevertheless, when interpersonal and intrapersonal differences in finishing time are also taken into consideration, certain hidden threshold level(s) in L2 might exist. In other words, time limit may become another source of demand. It has to be admitted that the concept of finishing time was not effectively analysed and this might have been the result of unclear definition. But the findings in the present research especially about the intrapersonal differences in finishing time did reveal to a certain extent the effect of bilingual proficiency on response automaticity (see Table 4.23 for analysis on students of different ability ranks).

If the attainment of the threshold level(s) in L2 operationalized as L2 reading proficiency can be a useful indicator of the students' capacity for proper linguistic and cognitive functioning in L2, then the problem does not necessarily lie in the students. The hidden demand in L2 listening as an external factor may healthily be modified.

Finally, the threshold level(s) in L2 explored in this present study is in fact a basic level with the maximum lexical demand restricted to the 3,000 conceptual range. In the academic context, more than basic, subject-specific concepts are also demanded, which should be embedded in the required background knowledge for the subject material. Accordingly, relatively higher subject-oriented threshold level(s) in L2 should be better stepping-stones for effective learning in the academic

situation. Further researches certainly are necessary.

CHAPTER 6 SUMMARY AND SUGGESTIONS

6.1 SUMMARY

The purpose of the present research was twofold. First, it was to investigate the effect of bilingual proficiency on the achievement in cognitive tasks. Second, it was to explore the possibility about the determination of the threshold level(s) in L2.

The threshold hypothesis is at a primitive stage. Therefore, the attempt for the determination of the threshold level(s) in L2 is justified only when the predictor-criterion relationship between L2 proficiency and cognitive functioning in L2 has been confirmed. In the present research, the emphasis was placed on the underlying logic and procedure for the estimation of the threshold level(s) in L2. And the attempt was made within a relatively complete framework of the causal relationship between bilingual proficiency and the achievement in cognitive tasks.

The present research was essentially a bilingual study on the Hong Kong secondary school students' understanding and cognitive functioning, revealed by the achievement scores and finishing time for the cognitive tasks chosen.

Two cohorts of Hong Kong secondary school students were sampled. In the main part of data analysis, there were 218 Secondary Two and 221 Secondary Four students participating in the study. They took the ESDOLEP language tests (Chinese reading, English reading and English listening) in 1990 and the two language versions of the cognitive tasks in 1991. These subjects of each academic level were divided into four different combinations of bilingual proficiency according to their linguistic levels in Chinese and English reading comprehension. As they all took the Chinese and English versions of the cognitive tasks, the effect of bilingual proficiency on the achievement in cognitive tasks could be tested and it was analysed mainly with one-way analysis of variance (ANOVA).

The types of tasks were chosen to assess the subjects' mastery in inferential comprehension and abstract reasoning. Regarding the cognitive tasks measure, there were two major characteristics worth mentioning: (1) criterion-referenced and (2) the two language versions being at least parallel. In fact, the cognitive tasks provided a measure of an intermediate criterion: cognitive functioning, linking the realistic sequential relationship between linguistic proficiency and academic achievement. Then, the two language versions being at least parallel were devised for comparing the language effect and for facilitating the estimation of the threshold level(s) in L2.

Statistically significant between-group differences were found in the achievement for the cognitive tasks, both in Chinese and English. The differences were especially obvious between those who were high in both languages and those who were low in both.

Next, the direct effect of English reading proficiency on the English cognitive tasks scores justified the estimation of the threshold level(s) in L2 on the English reading test scale. The threshold level(s) in L2 can be assumed as a task-oriented standard designated on an L2 language test scale. In the present research, it was estimated through a relevant regression back from the grade-appropriate cognitive demand for the English cognitive tasks.

In conclusion, better understanding about the threshold level(s) in L2 was gained. The findings had lent light to solve the research problem about the possibility of identifying the students who are capable of receiving education through L2. As the cognitive tasks were controlled within the 3,000 basic concepts, the threshold level(s) in L2 estimated would reflect some minimum communicative ability in the academic situation.

6.2 SUGGESTIONS

It is important to examine the generalization of the research findings. The cognitive tasks used in the present research were mostly designed for the secondary school levels and the samples were selected from two cohorts of secondary school students. The attempt for the estimation of the threshold level(s) in L2 is mostly applicable to the secondary school students. For academic levels lower or higher than the secondary school levels, more researches are certainly necessary.

To enhance the predictive validity of the L2 reading test for cognitive functioning in L2, very much larger samples resembling the normal distribution should be required. In fact, in the present research, there could have been some underestimation in the reliability coefficients of the language tests as well as the cognitive tasks mainly due to the small sample size. And finally, the predictive validity expressed in terms of correlation was underestimated. The reason is that the maximum correlation depend on the statistics of reliability of the relevant measurements. The reliability coefficient reflects the contribution of certain variables in addition to error variance in the formation of the total variance (see Crocker & Algina, 1986).

Proximity in time for the administration of the tests is probably essential for the L2 reading proficiency to predict the cognitive functioning in L2. This is one way to preserve the usefulness of the concurrent predictive validity coefficient for the estimation of the threshold

level(s) in L2. In the present research, the about-one-year discrepancy between the language tests and the cognitive tasks test did have changed to a certain extent the quality of prediction. But such a technical flaw can easily be corrected in future research.

For more refined analysis on finishing time, more sensitive measurement is definitely necessary. In the present research, the device for measuring finishing time as a crude assessment of the degree of cognitive involvement in the cognitive tasks of the two language versions might probably be valid, especially for those subjects who could achieve higher marks. But delicate analysis on the automaticity of language use was not accomplished.

Finally, the research problem was approached from the perspective of learning by students, and less from teaching by teachers. Further researches on teachers' training for bilingual education is certainly suitable.

Hong Kong, the background of the research, is a very special bilingual society. And the procedure for the estimation of the threshold level(s) in L2 was adapted and applied to such ethnical and linguistic environment as Hong Kong. To generalize the procedure to other communities, careful examination of the underlying logic is advisable, and the critical starting-point is probably at the selection of a suitable grade-appropriate level(s) for the L1 cognitive tasks within a suitable population, for example, with a majority language.

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APPENDIX A

Some General Instructions for the Teachers Responsible for the Administration of the Cognitive Tasks

「認知作業」的基本資料及測試程序

給教師/研究員的基本資料：

- 此測驗主要分為三部份：(1)答題紙、(2)中文卷及(3)英文卷。給學生的指示和例子印在第二頁。
- 整個測驗可長達 40 分鐘。請將以上所述三部份全部收回。
- 所有學生/受試者皆做同一測驗。但為着研究的原故，每班做中、英文卷的次序可能有別。
- 請教師/研究員向學生/受試者宣佈以下要點之前，首先分派釘有答題紙的部份

請教師/研究員用廣東話說出：

(1) 首先寫下個人資料。
(2) 測驗正式開始之後第 15 分鐘，若已完成第一卷，可交回第一卷，然後取另一卷作答。
(3) 尚未完成第一卷的同學可以繼續作答，但應在測驗正式開始之後第 20 分鐘交回第一卷，然後取另一卷作答。
(4) 每一卷的完成時間應由同學個別計算，並應由開始每一卷時開始計時。

謝謝！

FOR THE ADMINISTRATION OF THE COGNITIVE TASKS

Information for Teachers/Researchers:

-There are three main parts in the test: (1) Answer Sheet. (2) Chinese Section and (3) English Section. Instructions and examples are at the back of the answer sheet.

-The whole test should at most last for 40 minutes. And all the above-mentioned three parts should be collected.

-All students/subjects will receive the same test. But for research reasons, it has been arranged that some classes will take the Chinese Section first and then the English Section, and vice versa.

-The section with the Answer Sheet stapled should be distributed to the students/subjects first before the teachers/researchers give the following directions.

Directions for Students/Subjects To Be Given by Teachers /Researchers Just Before the Test: (In Cantonese)

(1) Write down the personal information.

(2) The first section will be collected for those who have finished at the end of the 15th minute, and the second section will then be distributed to them.

(3) For the rest of the students/subjects, the first section will be collected at the end of the 20th minute. Then the second section will be distributed to them.

(4) The finishing time for each section should be counted by the students/subjects themselves. They should start counting from the beginning of each section.

THANK YOU!

APPENDIX B

The Whole Instrument of the Cognitive Tasks

語文教學政策研究
認知作業

學校：_____ 班別：_____

姓名：（中文）_____（英文）_____

身份證號碼：_____ 性別：_____ 年齡：_____

答題紙

T＝對　　F＝錯　　O＝不明白題意，放棄作答

請在適當的位置上填上 ✓ 號。

中文組

	T	F	O
1.	☐	☐	☐
2.	☐	☐	☐
3.	☐	☐	☐
4.	☐	☐	☐
5.	☐	☐	☐
6.	☐	☐	☐
7.	☐	☐	☐
8.	☐	☐	☐
9.	☐	☐	☐
10.	☐	☐	☐
11.	☐	☐	☐
12.	☐	☐	☐
13.	☐	☐	☐
14.	☐	☐	☐
15.	☐	☐	☐
16.	☐	☐	☐
17.	☐	☐	☐
18.	☐	☐	☐
19.	☐	☐	☐
20.	☐	☐	☐
21.	☐	☐	☐
22.	☐	☐	☐
23.	☐	☐	☐
24.	☐	☐	☐
25.	☐	☐	☐
26.	☐	☐	☐

完成時間：

約____分鐘

ENGLISH SECTION

	T	F	O
(a).	☐	☐	☐
(b).	☐	☐	☐
(c).	☐	☐	☐
(d).	☐	☐	☐
(e).	☐	☐	☐
(f).	☐	☐	☐
(g).	☐	☐	☐
(h).	☐	☐	☐
(i).	☐	☐	☐
(j).	☐	☐	☐
(k).	☐	☐	☐
(l).	☐	☐	☐
(m).	☐	☐	☐
(n).	☐	☐	☐
(o).	☐	☐	☐
(p).	☐	☐	☐
(q).	☐	☐	☐
(r).	☐	☐	☐
(s).	☐	☐	☐
(t).	☐	☐	☐
(u).	☐	☐	☐
(v).	☐	☐	☐
(w).	☐	☐	☐
(x).	☐	☐	☐
(y).	☐	☐	☐
(z).	☐	☐	☐

Finishing time:

About _____ min.

指示：

全部52題，一半以中文寫成，另一半以英文寫成。
請先完成以其中一種語文所寫成的題目。
答題紙在第一頁（即封面），請小心撕下第一頁，並將你認為適當的答案填在適當的部份。
將首先完成的題目（中文／英文）交回有關老師／研究員，然後向有關老師／研究員取以另一種語文所寫成的題目。答案仍填在第一頁。
完成每一種語文所寫成的題目後，請即寫下完成所需的時間。

例子：

（甲）那裡有一張椅、一枝蠟燭、一些食物、一本書。

以下的句子能否總括上文？
(Is the following sentence a good main idea?)

那裡有些物件。　　（答案：T＝對）
那裡有書。　　（答案：F＝錯）
那裡有全部的東西。　　（答案：F＝錯）

（乙）阿樂的袋裡有很多厚書，它們非常重，阿樂下課上學讀書，但卻不願意帶那些石頭。

以下的句子對嗎？
(Is the following sentence true?)

厚書是很重的，石頭也是很重的。
（答案：T＝對）
阿樂的厚書重得像石頭。　（答案：T＝對）
阿樂需要帶石頭上學。　　（答案：F＝錯）

ENGLISH SECTION

(a). Dogs bark to frighten strangers. Birds fly away when frightened. Crabs have strong arms as weapons.

Is the following sentence a good main idea?
Animals have ways to protect themselves.

(b). Mary is four. She is very clever and likes to play very much. Once, she moved two of her fingers in the air. I smiled at her and she said, "It is how my Daddy walks."

Is the following sentence true?
Mary's father walks with his wings.

(c). For studying geography, a student usually needs an atlas. Peter has one. On Monday, he asked his elder brother to help him find the location of Hong Kong. They could find it but Peter could only see a dot.

Is the following sentence true?
A small round mark is used to represent Hong Kong in the map.

(d). Chocolate costs about six dollars and fifty cents for one hundred grams. A toothbrush may cost you ten dollars. A fan is worth about two hundred dollars. If you want to buy jewels, you may have to pay more than several thousands.

Is the following sentence a good main idea?
Different objects have different values.

(e). Last Saturday, Martin did some mathematics in his exercise book. Then, he cleaned his own sports shoes. He read the newspaper of the day after lunch. In the evening, he helped his neighbour to mend a bicycle.

Is the following sentence a good main idea?
Last Saturday, Martin did some things.

(f). The television is a very special window. Through it, people can see a lot of things and events without going outside. They can also learn more about foreign things, places and people.

Is the following sentence true?
People can know more by watching television.

(g). On Sunday, John destroyed his brother's toy train. On Tuesday, he lost his classmate's exercise book. On Wednesday, he stole his father's banknotes. On Friday, he stepped on a person's toes but did not say sorry.

Is the following sentence a good main idea?
John offended four persons in a few days.

(h). Poverty is a desert. A poor man may not have enough in everything. He does not have much food or clothing. He does not have a shelter. Above all, he is thirsty for love.

Is the following sentence true?
The poor people need water to drink.

(i). Jimmy put on a white shirt and a pair of red shorts. He tied a belt in the middle. He then had socks on his feet.

Is the following sentence a good main idea?
Jimmy put on some socks.

(j). Mary had a dream last night. In the dream, her diary stood up and grew taller than she was. It had strong branches and brightly shining leaves. Then, a pretty white bird came to make a nest.

Is the following sentence true?
The diary became something like a tree in the dream.

(k). Nobody is an island, but a piece of the continent. People in a society, directly or not directly, have some connection with one another. So we say that they are like a continent.

Is the following sentence true?
People can seldom live well without proper relationship with others.

(l). We felt the wind come from the right. Some very small animals ran across my feet. The leaves of the trees made many noises. The birds flew upwards. A feather fell onto Tom's head.

Is the following sentence a good main idea?
There were movements around us.

(m). I did not know how to study well. But when I looked at the nail on the wall, an idea came back. The nail was hanging a picture. I remembered what Miss Lee once said: We should learn the main ideas by heart.

Is the following sentence true?
In my mind, the nail could stand for the less important ideas.

(n). The ancient people started to make fire. Later, people controlled the water for farming. Much later, people controlled electricity. Recently, people have tried to control the rain.

Is the following sentence a good main idea?
Throughout history, people used fire and electricity.

(o). Smoking is bad for health. Smokers may get an illness in their chests. If the smoker's body is a society, there will be a growing number of bad citizens. Finally, the bad citizens destroy the whole society.

Is the following sentence true?
The smokers may die because some parts in their bodies are not healthy.

(p). Mr. Wong told the students to read a few pages before the next lesson. He said that they could use a dictionary if they wanted to. Also he asked them to bring some interesting photographs to class.

Is the following sentence a good main idea?
Mr. Wong told the students to do their best.

(q). Oranges are orange. Grass is green. Some flowers are blue. Some of our clothes are red. Some people are black. The sky is sometimes grey.

Is the following sentence a good main idea?
Everything in our world has colour.

(r). The enthusiasm of the famous singers' supporters is extraordinarily great. Many people do not understand this. It seems that some of the supporters will never accept the other gods.

(s). Father likes reading news on the paper. Mother enjoys cooking good meals. My small sister loves eating ice cream. My brother likes swimming and fishing. Some of my classmates like playing football.

Is the following sentence a good main idea?
Many of us like to do something.

(t). Diana rejoiced when she received her first little prize. She rejoiced when she was the champion on a sports day. She rejoiced when she graduated with three distinctions in Form Five. She rejoiced when she was accepted by her favourite university.

Is the following sentence a good main idea?
Diana was extremely happy when she got rewards.

(u). David lost a race at school. He was only sad for a moment. Then, he planned doing more exercises to become stronger. He did not want to be the hour hand of the clock again.

Is the following sentence true?
David wished to run faster than all the other runners.

(v). Helen drew a square with a half circle on top. Billy drew two squares and got a rectangle. Mary drew many triangles and then make a circle round them. James drew four triangles and made a kite.

Is the following sentence a good main idea?
The four persons drew shapes to make shapes.

(w). It is raining but the rain is small. I do not open the umbrella although I have one. I like to feel being touched by the hand of nature.

Is the following sentence true?
The rain on the umbrella is like fingers of the human hand.

(x). The little girl was trying to make a toast on the barbecue fire. She played while she was making it. Then, she returned but told her friends, "How can we eat a brick?"

Is the following sentence true?
The toast became as black as a brick.

(y). Elizer is searching for a rubber. Paul is listening to the teacher. Irene is listening to the teacher and writing notes. Susan is still correcting her classwork. Bob has been sleeping for several minutes.

Is the following sentence a good main idea?
Everyone there is working.

(z). To be a good leader is not easy. His age is not very important. He need not be rich. But he should be a light showing the way so that the others know more.

Is the following sentence true?
A good leader should know more than the others.

*** The End of the English Section ***

中文卷

1．不久之前，一批科學家製造儀器的時候犯了些錯誤，以致不能清楚地觀察太空裡的行星，最後他們計劃造一副眼鏡安放於儀器上。

以下的句子對嗎？
那些科學家認為那儀器與人的視力係相似。

2．爸爸和媽媽將那些床搬進睡房去，哥哥將貯物櫃拉近餐桌，而我將幾張椅子放在電視機對面。

以下的句子能否總括上文？
我和家人搬動家具。

3．那小女孩嗜試在燒烤爐上烘多士，邊烘邊玩耍，到她回來時，祇能對朋友說：磚頭怎可以吃呢！

以下的句子對嗎？
多士變黑像一塊磚。

4．黃老師吩咐同學在上下一課前閱讀幾頁書，他說若有需要他們可以查字典，他還要求他們帶些有趣的相片回來。

以下的句子能否總括上文？
黃老師叫同學預備一些相片。

5．名歌手的擁護者非常熱情，很多人都不明白，似乎有些歌迷還永不會接納別些神呢。

以下的句子對嗎？
有些名歌手的擁護者忠於自己的選擇。

6．我不知道如何有效地學習，但當我望着牆上的釘，便想起來了，那釘掛着一幅圖畫，我記得李老師說過：我們應熟讀重點。

以下的句子對嗎？
我從釘子聯想到細節。

7．我愛看電視和集郵，媽媽享受煮一頓豐富食物的樂趣，小弟弟喜歡游泳和釣魚，我有些同學喜歡踢足球，我的堂妹雖然很肥胖仍要吃很多。

以下的句子能否總括上文？
不同的人有不同的興趣。

8．海珍劃了一個正方形，上端有一個半圓形；小李劃了兩個正方形，得出一個長方形；阿龍劃了很多三角形，然後在周圍劃了個圓圈；阿正劃了四個三角形，合起來是個風箏的模樣。

以下的句子能否總括上文？
那四人用圖形構成形狀。

9．我們感覺風從右邊來，幾隻小動物經我腳上跑過，街基發出聲響，雀鳥向上而飛，一根羽毛掉在阿唐的頭上。

以下的句子能否總括上文？
聲一響，雀鳥飛走了。

10. 貧窮是沙漠，貧窮的人可能在所有東西上都缺乏，沒有足夠的食物或衣服，沒有遮蔽的地方，更重要的是他們渴求愛心。

以下的句子對嗎？
貧窮的人需要別人關懷他們。

11. 小貓在找尋一塊膠席，博文在聽老師說話，愛蓮在一邊聽老師說話一邊寫筆記，阿珊還在改正堂課，阿軍已睡著數分鐘了。

以下的句子能否總括上文？
那裡的人在工作。

12. 阿力剛買了他第一本地圖集，打開來看，見頁上滿是七彩的形狀，他的哥哥幫助他尋找香港的位置，找到了，但阿力只看到一小圓點。

以下的句子對嗎？
在那地圖上香港是用一個不規則形狀來代表的。

13. 現在正在下雨，但雨細，我雖然有傘，但卻沒有把它張開，給大自然的手觸摸是很好的感覺。

以下的句子對嗎？
雨接觸著我。

14. 當淑兒獲得第一份小小的獎品時，她感到高興；在運動會中贏得冠軍，她感到高興；中五畢業時，考得三優成績，她感到高興。

以下的句子能否總括上文？
當淑兒得到獎勵時，她非常快樂。

15. 成為好領袖不是容易的。體型還不太重要，也不需要富有，但他應是一盞明燈，誘導別人知得更多。

以下的句子對嗎？
一位好領袖應比別人光芒四射。

16. 德仔對於在三兄弟中跑得最快感到很自豪，他常常說他是秒針，肥胖的兄弟是分針，還是幼兒的弟弟是時針。

以下的句子對嗎？
德仔的幼兒兄弟跑得最慢。

17. 星期一，阿尖破壞妹妹的洋娃娃；星期二，他遺失了同學的練習簿；星期三，他偷了他媽媽的錢包；星期五，他踩著別人的腳趾但一聲對不起也沒說。

以下的句子能否總括上文？
阿尖在一年內開罪了四個人。

18. 電視是一個非常特別的窗，人可足不出戶從這窗向外看見許多東西和事情，他們還可熟悉更多有關外國的事物、地方和人民。

以下的句子對嗎？
人能從收看電視知道更多。

19. 阿積穿上一件白恤衫和一條紅短褲，在中間繫上腰帶，跟着在腳上穿上短襪。

以下的句子能否總括上文？
阿積穿上了短襪。

20. 古代的人開始支配一些動物，後來的人控制水以利耕種，很久以後，人能控制電力，最近的人還控制雨。

以下的句子能否總括上文？
人類在歷史上不斷嘗試控制自然界。

21. 吸煙對健康有害。吸煙者肺部可能生病，結果吸煙者的身體是社會，市民中就有不斷增長的壞份子，最後，壞份子毀滅整個社會。

以下的句子對嗎？
吸煙者身體內有些部份生了毛病，所以可能會死亡。

22. 上星期天，大偉做了點家課和學些生字，跟着清潔自己的運動鞋，午飯後便閱讀當日的報紙，黃昏之後，他還幫爺人修整腳踏車。

以下的句子能否總括上文？
上星期日，大偉做了些事情。

23. 橙是橙黃的，草是綠的，有些花是藍的，我們有些衣服是紅的，有些人是黑的，天空有時是灰的。

以下的句子能否總括上文？
世界上所有東西都有顏色。

24. 朱古力約六元五角一百克；你買一只牙刷可能要付十元；一把風扇約值二百元；如果你想買寶石，可能需支付數千元以上。

以下的句子能否總括上文？
不同的物品有不同的價值。

25. 因為我們常常需要別人幫助我們，所以有時可能我們應該幫助別人。古語有云：人不是小島，而是大洲的一部份。

以下的句子對嗎？
人與人應該彼此有聯繫。

26. 芳芳昨夜發了一個夢，夢中她的日記簿站立了起來，生長得比她更高，有粗大的枝和光滑的葉子，之後，有一可愛的白鳥飛來築了一個巢。

以下的句子對嗎？
日記簿在夢中變得像一株樹。

〔中文卷完〕

APPENDIX C

A Table about the Distribution of the Items for the Cognitive Tasks

In 1,500 Basic Vocabulary Range

Summarization			Analogical Reasoning		
Chinese		English	Chinese		English
4		p	6	---------	m
7		s	13		w
8	---------	v	15		z
19	---------	i	16		u
22		e	18	---------	f
23	---------	q	26	---------	j

In 3,000 Basic Vocabulary Range

Summarization			Analogical Reasoning		
Chinese		English	Chinese		English
9		l	3	---------	x
11	---------	y	5	----?----	r
14	?	t	10		h
17		g	12		c
20		n	21	---------	o
24	---------	d	25		k

KEY: --- The same in concepts
? Having some problems

APPENDIX D

The Reliability Coefficients for the Cognitive Tasks

By using Livingston's $K^2(X,T)$, the reliability coefficients for the cognitive tasks, which are essentially criterion-referenced, may be computed. The relevant equation of the $K^2(X,T)$ is:

$$K^2(X,T) = \frac{SD_x^2\ (KR20) + (\mu_x - n_iC)^2}{SD_x^2 + (\mu_x - n_iC)^2}$$

(equation from Crocker & Algina, 1986) where n_iC is the standard in marks; and the alpha coefficients presented in Chapter 3 are in fact KR20. Here, it is essential to note that the reliability coefficients vary with the standard.

The following table shows such reliability coefficients in relation to the grade-appropriate level(s) or the grade-appropriate demand level(s) (GADL) for the cognitive tasks (refer to Chapter 3 and Table 5.41 for relevant descriptive statistics for computation).

Cognitive Tasks	N	$K^2(X,T)$
Secondary 2:		
At 16 Marks		
CTCR	428	.59
CTER	428	.78
Secondary 4:		
At 17 Marks		
CTCR	445	.40
CTER	445	.68

APPENDIX E

The Frequencies about the Chinese Cognitive Tasks Scores of the Secondary-Two Students

VALUE	FREQUENCY	PERCENT	VALID PERCENT	CUM PERCENT
4.00	1	.2	.2	.2
5.00	1	.2	.2	.5
6.00	1	.2	.2	.7
7.00	5	1.2	1.2	1.9
8.00	3	.7	.7	2.6
9.00	5	1.2	1.2	3.7
10.00	5	1.2	1.2	4.9
11.00	6	1.4	1.4	6.3
12.00	23	5.4	5.4	11.7
13.00	25	5.8	5.8	17.5
14.00	31	7.2	7.2	24.8
15.00	41	9.6	9.6	34.3
16.00	58	13.6	13.6	47.9
17.00	75	17.5	17.5	65.4
18.00	62	14.5	14.5	79.9
19.00	44	10.3	10.3	90.2
20.00	32	7.5	7.5	97.7
21.00	7	1.6	1.6	99.3
22.00	3	.7	.7	100.0
TOTAL	428	100.0	100.0	

APPENDIX F

The Frequencies about the English Cognitive Tasks Scores of the Secondary-Two Students

VALUE	FREQUENCY	PERCENT	VALID PERCENT	CUM PERCENT
.00	1	.2	.2	.2
2.00	1	.2	.2	.5
3.00	2	.5	.5	.9
4.00	3	.7	.7	1.6
5.00	2	.5	.5	2.1
6.00	10	2.3	2.3	4.4
7.00	7	1.6	1.6	6.1
8.00	14	3.3	3.3	9.3
9.00	9	2.1	2.1	11.4
10.00	27	6.3	6.3	17.8
11.00	47	11.0	11.0	28.7
12.00	42	9.8	9.8	38.6
13.00	38	8.9	8.9	47.4
14.00	47	11.0	11.0	58.4
15.00	54	12.6	12.6	71.0
16.00	46	10.7	10.7	81.8
17.00	45	10.5	10.5	92.3
18.00	18	4.2	4.2	96.5
19.00	10	2.3	2.3	98.8
20.00	4	.9	.9	99.8
22.00	1	.2	.2	100.0
TOTAL	428	100.0	100.0	

APPENDIX G

The Frequencies about the Chinese Cognitive Tasks Scores of the Secondary-Four Students

VALUE	FREQUENCY	PERCENT	VALID PERCENT	CUM PERCENT
7.00	2	.4	.4	.4
9.00	1	.2	.2	.7
10.00	3	.7	.7	1.3
11.00	4	.9	.9	2.2
12.00	8	1.8	1.8	4.0
13.00	14	3.1	3.1	7.2
14.00	24	5.4	5.4	12.6
15.00	36	8.1	8.1	20.7
16.00	62	13.9	13.9	34.6
17.00	70	15.7	15.7	50.3
18.00	83	18.7	18.7	69.0
19.00	76	17.1	17.1	86.1
20.00	45	10.1	10.1	96.2
21.00	17	3.8	3.8	100.0
TOTAL	445	100.0	100.0	

APPENDIX H

The Frequencies about the English Cognitive Tasks Scores of the Secondary-Four Students

VALUE	FREQUENCY	PERCENT	VALID PERCENT	CUM PERCENT
6.00	3	.7	.7	.7
7.00	1	.2	.2	.9
8.00	6	1.3	1.3	2.2
9.00	15	3.4	3.4	5.6
10.00	13	2.9	2.9	8.5
11.00	15	3.4	3.4	11.9
12.00	38	8.5	8.5	20.4
13.00	38	8.5	8.5	29.0
14.00	61	13.7	13.7	42.7
15.00	59	13.3	13.3	56.0
16.00	69	15.5	15.5	71.5
17.00	54	12.1	12.1	83.6
18.00	43	9.7	9.7	93.3
19.00	18	4.0	4.0	97.3
20.00	10	2.2	2.2	99.6
21.00	2	.4	.4	100.0
TOTAL	445	100.0	100.0	

APPENDIX I

A List of the Abbreviations Used in the Data Analysis and Its Corresponding Labels or Meanings

Abbreviation	Meaning
SM	Summarization
AR	Analogical Reasoning
MARKC	Cognitive Tasks in Chinese with 24 Items
MARKE	Cognitive Tasks in English with 24 Items
CTCR	Cognitive Tasks in Chinese, Revised, with 23 Items
CTER	Cognitive Tasks in English, Revised, with 23 Items
FTCS	Finishing Time in Minutes for the Chinese Version with 26 Items
FTES	Finishing Time in Minutes for the English Version with 26 Items
CVOF	Cognitive Tasks in Chinese 1,500 Basic Vocabulary Range, with 12 Items
CVTH	Cognitive Tasks in Chinese 3,000 Basic Vocabulary Range, with 12 Items
EVOF	Cognitive Tasks in English 1,500 Basic Vocabulary Range, with 12 Items
EVTH	Cognitive Tasks in English 3,000 Basic Vocabulary Range, with 12 Items
CHIR	Chinese Reading
ENGR	English Reading
ENGL	English Listening
BPG	Different Combinations of Bilingual Proficiency
RK	Rank, Differentiating the Students According to Basic Intellectual Ability